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ANNUAL REPORT  
OF THE  
CHIEF SIGNAL OFFICER  
—  
1905











# ANNUAL REPORT

OF THE

CHIEF SIGNAL OFFICER, U. S. ARMY,

FOR THE

FISCAL YEAR ENDING JUNE 30, 1905.



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1905.



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REPORT  
OF THE  
CHIEF SIGNAL OFFICER OF THE ARMY.

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WAR DEPARTMENT,  
OFFICE OF THE CHIEF SIGNAL OFFICER,  
*Washington, September 30, 1905.*

SIR: I have the honor to submit my annual report of the Signal Corps of the Army for the fiscal year ending June 30, 1905.

SCOPE AND CONDITIONS.

The Signal Corps maintains military lines of information by telegraphy (wireless, aerial, and submarine), by telephony, by visual signaling, by ballooning, and by other collateral methods. It also devises and furnishes the electrical apparatus for the fire-control and fire-direction system of both the coast defenses and of field artillery. Incidentally it operates for commercial purposes military telegraph lines when such lines are not occupied with official business.

Except as to military aerostation, which is in an evolutionary stage, the Signal Corps is in the most efficient condition within its history. Its military telegraph lines are doing excellent service. Visual signaling has received unusual attention. Post telephone systems and rifle ranges are as fully installed as appropriations permit. Its wireless telegraph service challenges comparison. The many submarine cables are in excellent working order, except one, where expensive repair material is lacking. Its electrical fire-control system for coast defenses is deemed superior to that of any other nation.

As to readiness for campaigning, it is to be said that at an hour's notice the Signal Corps can furnish field trains capable of installing and operating buzzer, telegraph, and telephone lines to the extent of 1,000 miles, under conditions which will insure constant and reliable intercommunication between any moving troops—artillery, infantry, or cavalry.

Suitable supplementary service by visual signals is also available, and the portable wireless system is being perfected.

Special attention has been paid to the rapid development of lines of information as installed and operated in the military maneuvers of Europe during the South African contest and in the Russo-Japanese war. Careful studies of foreign methods have shown deficiencies in the American Army only in connection with the fire control and fire direction of field artillery, which deficiency, on the recommendation of the Chief Signal Officer of the Army, and with the approval of the Chief of Staff, is in process of remedy.

## ALASKAN TELEGRAPH SYSTEM.

For convenient reference, field operations are treated geographically under the headings of Alaska, the Philippines, and the United States.

This work was initiated by acts of Congress approved May 26, 1900, March 2, 1901, and June 30, 1902. In accordance with the recommendations of the Secretary of War in his annual report of 1902, Congress, by an act approved March 3, 1903, authorized the connection of Seattle by cable with southeastern Alaska, where the military posts of Skagway and Fort William H. Seward (Haines Mission) were telegraphically reached only over Canadian lines. Current results amply confirm the wisdom of the Secretary of War in this recommendation. Great benefits have resulted, both civil and military. The President and the War and Navy Departments now have direct telegraphic communication with the five military posts and the naval station in Alaska, and also with the nearest ice-free harbor in the settled portion of North America to the Asiatic coast. The military importance of the lines from a strategic standpoint is beyond question.

Commercially the system has been of very great value in conserving and fostering the business interests of Alaska, from which Territory nearly \$30,000,000 worth of products have been exported to the United States during the past year. The enormously productive mining districts of southeastern Alaska, of the Tanana Valley, and of the Nome region are adequately served; most of the great fish canneries are contiguous to telegraph stations; the administration of justice is efficiently promoted; the transaction of public business greatly facilitated; the life of the Alaskan pioneer is made brighter and more civilized. As regards relief of extensive destitution the telegraph system affords information for intelligent and economical action, as is shown by its refuting false rumors, which this year duplicated the Dawson fabrication of 1898 on which \$195,000 was uselessly expended.

The telegraph system, considered primarily desirable for military purposes, is to-day industrially and commercially indispensable, and through its facilities Alaskan business methods and commercial enterprises have been administered with greater advantage than ever before. The telegraph, so necessary to supplement daily mails in the United States, is immensely more important in a region where mails are entirely lacking for months at a time and are infrequent during the rest of the year. This necessity is emphatically demonstrated by an immense volume of telegraphic business, whose tariffs, exceeding \$100,000 the past year, will annually approximate \$200,000 in coming years.

## ADMINISTRATION.

During the greater part of the year the Alaskan system has been under the direction of Maj. W. A. Glassford, Signal Corps, at the Seattle end of the Alaskan cable, in addition to doing duty as chief signal officer Department of the Columbia. By previsionary measures and systematic methods he has materially improved the administration of the system, and is entitled to credit for its generally increased efficiency.

Brig. Gen. Constant Williams, commanding Department of the Columbia, has contributed largely to the success of the system by his hearty support and cooperation, which have been seconded by his staff.

Major Glassford's assistants were Capts. Otto A. Nesmith and Leonard D. Wildman, First Lieuts. John E. Hemphill and William C. Fitzpatrick, Signal Corps. Captain Nesmith successfully administered line work from Fort Egbert. Lieutenant Hemphill at Nome, and Lieutenant Fitzpatrick at Fort Gibbon, not only ably supervised the work of maintenance, supply, and repair, but also displayed great activity in the field, inspecting and cheering their men by long and arduous winter journeys. With rare exceptions the officers of the line in Alaska have heartily cooperated, and the Signal Corps has endeavored to ameliorate Alaskan conditions through military press bulletins and facilities for social communication.

## STATIONS AND DISTANCES.

Its totality comprises elements not elsewhere combined in a single system; submarine, land, and wireless sections are worked as a component and harmonious whole. The construction aggregates to date 4,038 miles, including not only 2,434 miles of cable and 1,497 miles of land lines, but also a wireless section of 107 miles. Two hundred and eight miles have been abandoned, 3,830 being operated. The inclosed map makes clear situations that can not be easily described:

	Inter- mediate.	Total.		Inter- mediate.	Total.
<b>NOME-VALDEZ SECTION.</b>			<b>FORT EGBERT BRANCH.</b>		
<i>Wireless lines.</i>			<i>Land lines.</i>		
Safety to Fort St. Michael.....	Miles. 107	Miles. 131	Ketchumstock .....	Miles. 0	1,370
<i>Land lines.</i>			Gold Creek .....	11	1,381
Nome .....	0	0	North Fork.....	19	1,400
Fort Davis.....	4	4	Champion Creek .....	39	1,439
Safety .....	20	24	Fort Egbert .....	29	1,468
Fort St. Michael.....	107	131	Boundary .....	11	1,479
Golsovia.....	35	166			
Unalaklik .....	30	196	<b>RAMPART BRANCH.</b>		
Old Woman .....	50	246	<i>Land lines.</i>		
Kaltag .....	45	291	Rampart .....	0	1,479
Nulato .....	40	331	Glen .....	35	1,514
Koyukuk .....	30	361	Baker .....	15	1,529
Grimkop .....	20	381			
Louden.....	30	411	<b>SEATTLE-VALDEZ CABLE.</b>		
Melozl.....	35	446	[Fort Lawton to Fort Liscum.]		
Kokrines.....	38	484	Fort Lawton .....	0	1,529
Birches.....	40	524	Seattle .....	3	1,532
Fort Gibbon.....	55	579	Sitka .....	1,037	2,569
Cosna .....	45	624	Valdez .....	601	3,170
Bakera .....	25	649	Fort Liscum .....	4	3,174
Tolovana.....	37	686			
Nenana .....	55	741	<b>VALDEZ-SEWARD CABLE.</b>		
Chena .....	48	789	Seward .....	0	3,174
Fairbanks .....	10	799	Valdez .....	200	3,374.
Salcha.....	37	836			
Goodpaster <sup>b</sup> .....	60	896	<b>SITKA-SKAGWAY CABLE.</b>		
Central .....	32	928	Sitka .....	0	3,374
Summit .....	58	986	Juneau .....	291	3,665
Ketchumstock .....	54	1,040	Fort W. H. Seward (Haines		
Dennison Creek .....	30	1,070	Mission).....	102	3,767
Tanana Crossing .....	25	1,095	Skagway .....	21	3,788
Big Tokio .....	31	1,126			
Mentasta Pass .....	20	1,146	<b>LAWTON-WORDEN BRANCH</b>		
Cheslotta.....	20	1,166	<b>CABLE.</b>		
Chistochina.....	26	1,192	[Spare cable.]		
Talsona.....	20	1,212	Fort Lawton .....	0	3,788
Kulkana .....	20	1,232	Fort Worden .....	42	3,830
Copper Center.....	26	1,258			
Tonsina .....	25	1,283			
Teikhell.....	24	1,307			
Saina .....	24	1,331			
Keystone.....	19	1,350			
Valdez .....	12	1,362			
Fort Liscum.....	8	1,370			

<sup>a</sup> Under orders to remove to Hot Springs.<sup>b</sup> Burned. To be reconstructed at McCarthy, Big Delta, and Delta station added at Little Delta River.

## OPERATION OF ALASKAN CABLES.

The submarine cables of southeastern Alaska, 2,300 miles in length, have been maintained and operated with entire success.

Ignoring the work of the commissioned officers, it is to be said that the enlisted men of the Signal Corps on cable duty have illustrated anew the ability, intelligence, and resourcefulness of the American soldier. Without exception every cable message has been transmitted and received by selected enlisted men, who qualified themselves for this difficult technical work with a rapidity and skill that were most gratifying. There is now in the Signal Corps a force of about 30 men so skilled in splicing, testing, and operating submarine cables that to-day the Signal Corps of the Army is competent to operate any submarine cable under war emergencies.

The military importance of these conditions is evident from the fact that no other army in the world has a similarly trained cable force. Experiences of late wars indicate the great tactical value of cable service. Of it Colonel May, in Imperial Defense, says:

Early intelligence in naval warfare is as valuable as a reenforcement of many ships. Rapid cable laying in time of war is a problem of imperial defense of the first importance.

As previously stated, the initiation of the Alaskan cable was planned and executed with great haste, the immediate establishment of an all-American route to Alaska being deemed of wise prevision. This involved the necessity of laying a deep-sea cable over an unsurveyed ocean bed near to and parallel with a rocky and precipitous coast, an unprecedented action in cable operations which under less urgent conditions would not have been favored by the Chief Signal Officer of the Army.

It develops that these gradients of ocean depths are most abrupt, instead of being gradual, as was indicated by existent soundings. In latitude  $54^{\circ} 03'$  north, longitude  $134^{\circ} 10'$  west, where by interpolation from adjacent soundings a depth of 1,519 fathoms was expected, there was later found a depth of only 807 fathoms, the cable having been laid over a submarine mountain of 4,200 feet. Similarly in latitude  $59^{\circ} 23'$  north, longitude  $142^{\circ} 27'$  west, in removing a cable fault there was found a depth of 1,027 fathoms as against 700 by the latest charts. The maximum depth is 1,600 fathoms.

Despite these untoward physical conditions there has been but one interruption in the Seattle-Sitka section of 1,037 miles, and one upon the Sitka-Valdez cable of 601 miles. Neither interruption was due to any fault in construction or installation, but to mechanical injuries. The first cable was damaged probably by an anchor in the bay near Fort Lawton, and the latter by the enmeshment of a large humpback whale (*Megaptera-nodosa*), which was found dead and entangled in the Valdez cable when repairs were made at the mouth of Sitka Harbor.

As stated in my last report, the Norton Sound cable from Nome to St. Michael was so seriously damaged by heavy ice during successive winters as to demonstrate the impracticability of successful cable operations, except at great expense and by a modified route. Its replacement by a most satisfactory wireless system caused the Chief Signal Officer of the Army to recover such portions of the cable as are not destroyed, with a view to their utilization elsewhere. Ten miles only were recovered, found in the original position; the remainder had dis-

appeared. Such disappearance can not be satisfactorily attributed to ice conditions, as indications point to extraneous methods of removal.

#### VALDEZ-SEWARD CABLE.

On April 23, 1904, Congress appropriated the sum of \$321,580 for the completion of an all-American telegraph route to Alaska, supplementing the Seattle-Skagway cable by one from Sitka to Fort Lisicum (Valdez). By the act approved March 2, 1905, Congress further appropriated the sum of \$95,000 for the extension of the submarine cable from Valdez to Seward at the head of Resurrection Bay, the southern terminus of the Alaskan Central Railway.

In connecting Valdez with Seward, the Chief Signal Officer of the Army adhered to his previous policy of installing a seamless rubber cable of American manufacture, to be operated by American soldiers, and to be laid by an American ship. By this policy not only have the economical interests of the United States been subserved, but there are now available in the American Army instruments, equipment, and personnel competent to install, operate, repair, or disable submarine cables of any length, in depths not exceeding 2,000 fathoms.

The act of March 2, 1905, made the appropriation for the Valdez-Seward cable immediately available. The short Alaskan season necessitated speedy action to insure the installation of this cable during 1905. The character of the ocean bed between Seward and Valdez was unknown, and must necessarily be roughly determined by a running survey.

Public proposals were at once invited, and the results illustrate American ability and resourcefulness in a new field, four American corporations bidding for the work. The award was made March 17, 1905, to the Safety Insulated Wire and Cable Company, of New York City, who completed by May 23, 1905, the entire cable—223 miles of deep-sea, intermediate, and shore-end types. It was transported by rail from Bayonne, N. J., to Seattle in twenty-four days. Its transfer to the cable tanks of the U. S. transport *Burnside*, assigned to duty as a cable ship, was made with great care under the supervision of Capt. Charles S. Wallace and Cable Engineer Henry Winter, the work being done by a trained Filipino cable crew. The *Burnside*, delayed at Seattle from causes not within control of this Bureau, reached Valdez and commenced operations on July 31. By August 3 the cable was laid to Seward without accident or interruption. The elapsed time from the approval of the appropriation bill to the cable reaching Seward was five months, which in case of necessity could have been materially reduced.

#### CABLE EXTENSIONS.

From a military standpoint it is not clear that there should be further extensions, unless Ketchikan be deemed strategically important from the conjoined facts of its proximity to Port Simpson, the projected terminus of the new transcontinental Canadian railway, and its position as the official port of entry to southeastern Alaska. Naturally, if a naval station is located on the Aleutian Islands it should be connected with the Alaskan system either by cable from Seward or by wireless from Nome, via a relay station on Nunivak Island.

It is suggested, also, as a relief to the National Treasury, that the line receipts from the Alaskan system be spent in a manner similar to

the taxes for Alaskan roads. Such legislative action is recommended, with a provision that extensions shall be made on the approval of the President and be reported annually to Congress. The Alaskan pioneers are now paying Government telegraph tariffs at the rate of more than \$100,000 annually, and such legislation appears to be equitable to them.

#### CABLE REPAIRS.

To insure suitable personnel, machinery and reserve cable for serious interruptions which might occur when Congress is not in session, an appropriation of \$50,000, available until expended, was made by the act of March 2, 1905, for the repair of military deep-sea cables, either for Alaska or the Philippines. No portion of this money has yet been spent, but a duplicate set of cable machinery will soon be purchased and a suitable tank built for storage of surplus Alaskan cable.

The installation and repairs of the Alaskan cables have been made by the U. S. transport *Burnside*, fitted up as a cable ship. While of somewhat defective construction for such purposes, yet she has been thoroughly equipped with modern cable machinery, testing room, etc., and under command of Capt. Charles S. Wallace, Signal Corps, has most satisfactorily performed her work in Alaskan waters. It is of the utmost importance that she should not be detached from this duty, which, with the care of the submarine cables for coast defenses in Puget Sound, imperatively and constantly demands a staunch and well-fitted seagoing boat. Strangely enough, the most difficult cable work done by the *Burnside* was the installation of the coast-defense cables between Forts Casey, Flagler, and Worden. The *Burnside* should be laid up in Puget Sound, naturally with a reduced personnel, ready for sailing orders in an emergency.

The following extract from the annual report of Maj. W. A. Glassford, in charge of the Alaskan telegraph system, shows the necessity of such action:

Cable interruptions through various causes are invariably to be anticipated, therefore suitable provisional means for quick transport to the point of trouble, carrying the necessary force, repair material, machinery, and grapnels to raise the cable to the surface from the deep-sea floor upon which it lies, must always be in readiness.

The cable ship *Burnside* is at present equipped for this purpose, with rendezvous at Seattle. So important has the commercial business become between Seattle and Alaska (averaging more than \$10,000 per month) that any long interruption of the cable becomes almost an industrial catastrophe, hence there is an absolute necessity for this cable ship to be at some calling point between the terminals of the cable of Resurrection Bay and Puget Sound. The usefulness of having the *Burnside* within calling distance is illustrated by the interruption which occurred last May in Puget Sound; the *Burnside*, then just running into Sitka, proceeded south at once and the cable was restored to operation within four working days of its interruption.

#### LAND LINES.

The construction of the Alaskan land lines, 1,422 miles in length, was an undertaking of extreme difficulty, owing to the uninhabited districts, almost inaccessibility, difficult transportation, remoteness from centers of industry, and particularly from the absence of roads or trails. Even to-day there are more than 1,300 miles of line through a country where no wheeled conveyance can travel in summer.

The maintenance of the line taxes to a greater extent the resources of the Army than did its original construction, for the latter was by

large parties and the former is by individuals. Every one familiar with the Alaskan country back from its rivers expresses surprise at both construction and maintenance.

#### LINE INTERRUPTIONS.

The conditions considered, the continuity and reliability of the service has been beyond expectation, the interruptions between Valdez and Nome, the extremes of the line, being 40.7 days, 1 day in 9, and between Valdez and Fairbanks (the great Tanana center) only 17.7 days, or 1 day in 20. Half of the interruptions occurred in June, owing to forest fires in the upper Tanana, and unprecedented flood conditions in the lower valley.

This unusually efficient service is the result of devoted field work by the Signal Corps, assisted by men of the line. The duty involved much winter travel and field service of an arduous character, in which Lieutenants Hemphill and Fitzpatrick have shared.

On this subject Major Glassford says:

The interruptions during the winter were reduced to about one-half of those of previous years, due to the energy and zeal of the repair men who patrolled the line on their section. Extreme suffering was experienced by repair men during severe storms, and in one instance a break on the Yukon forced the repair parties to leave their stations, when soft, deep snow, which made traveling slow by snowshoes, in some cases prevented the men from reaching relief cabins and forced them to seek shelter in thickly wooded places where fires could be made.

In view of the fact that through persistent betterments there has been so considerable a time of uninterrupted communication between the United States and the great mining centers of Alaska, and also from the fact that this same telegraph line has stimulated these mining industries to a point not before thought of, it has become the duty of the Government to correct the line to such an extent that frequent and prolonged interruptions may not be reasonably anticipated.

The interests involved, which may be said to be measured by the line receipts amounting to about \$10,000 per month, seem to permit a slighting of this consideration.

#### TELEGRAPH RESERVATIONS.

The establishment of telegraph stations has affected the status of miners and other settlers entering Alaska, especially in the valleys of the Tanana and of the Copper River. In a number of instances squatters have built undesirable establishments near to telegraph cabins, and others, when in legitimate pursuits, have attempted to prevent the Signal Corps from obtaining from contiguous land fuel or telegraph poles for necessary repairs. This was certain to be followed by objections to the felling of timber for a telegraph right of way.

To forestall trouble and protect the interests of the United States, the Chief Signal Officer of the Army recommended that there be withdrawn from settlement a telegraph right of way, 100 feet wide, along the military lines from Valdez to Fort Egbert, from Fort Egbert to Boundary, from North Fork to Fort Gibbon, from Baker to Rampart, from Fort Gibbon to St. Michael, from Safety Harbor to Fort Davis, and in addition that small reservations be declared for the telegraph offices, store houses, and stables at repair stations in Alaska. This action was approved, as announced in General Orders, No. 83, June 5, 1905, the President of the United States having set apart, by order dated May 24, 1905, these reservations for the use and maintenance of military lines in Alaska, subject to private rights.

A lease of a portion of the reservation at Chena, which was considered necessary for use of the Tanana Mines Railway Company to



reach suitable deep water, was made by the Secretary of War, on the recommendation of the Chief Signal Officer of the Army, for a term of years at a rental of \$100, payable annually to the United States.

#### REPAIRS AND REPAIR STATIONS.

Of the 47 stations on land lines only 10 are maintained (5 at military posts and 5 at important towns) for military or commercial purposes, the remaining 37 being for repair purposes. These stations, averaging about 40 miles apart, were originally manned by one signal corps man with two assistants from the line of the Army, experience having demonstrated the extreme danger of sending a repair man alone through an uninhabited country in stormy or wintry weather. Each detachment is provided for a year in advance by supplies sledged in in mid-winter, this work usually beginning in November and continuing until March. With occasional blizzards and very heavy snowfalls, and temperatures as low as 60° below zero, winter service is of the most dangerous and trying character. The soldier's life is not only thus arduous, but extremely monotonous owing to the isolation from the world, months sometimes passing without even the face of a native being seen.

The relief of the Eighth Infantry by the Third Infantry in 1904 resulted, through misunderstandings, in the practical abandonment of half of the repair stations by the line of the Army, greatly increasing the labor and dangers of the inadequate force of the Signal Corps. Proper representations have been made regarding this subject to Gen. Constant Williams, commanding the Department of the Columbia, who promptly issued orders that the line of the Army should in the future bear its part of these burdens equally with the Signal Corps.

The repair work of the enlisted men, whether of the line or of the Signal Corps, is an arduous and dangerous duty, which has been performed in almost every case with fidelity and in many cases under conditions akin to heroism.

On this subject Maj. W. A. Glassford reports:

Master Signal Electrician Bauer, Sergeant Kyttle, Corporal Herb, Privates Beloat and Cavanaugh performed exceptional service on the line during January. Privates Ferris and Shoemaker, Third Infantry, should be mentioned for their work in removing trees from the line for a distance of 37 miles and putting a section of the line in order in the midst of a blizzard.

Practically all the men serving in Alaska deserve mention for their services under the severe conditions it imposes, contributing by the performance of hard-earned work to the credit of the service. Any list would be incomplete without the roll of all the men in Alaska whose services under the circumstances entitle them to the gratitude belonging to the faithful soldier.

It should be added that First Lieuts. John E. Hemphill and William C. Fitzpatrick, Signal Corps, have shared the hardships and fortunes of the enlisted men in the field during the past winter with creditable fortitude and unflinching determination. Unfortunately, Lieutenant Fitzpatrick's health was undermined by his work in the field, necessitating his summary relief and transfer to the general hospital at Fort Bayard, N. Mex.

Fortunately, through precautions taken, the enlisted men have, save in one instance, served without casualty on repair duty during the year, although in many instances men were in danger more or less imminent. The casualty referred to occurred at Old Woman station at the base of a precipitous mountain, where Private Watson, Com-

pany G, Seventh Infantry, lost his life through being caught in a snow-slide. As there was constant danger during the winter months of the entire detachment being crushed in like manner, a new cabin has been built some distance from the old site.

#### CONDITION OF THE ENLISTED MEN.

During the past year a special report of a line officer dwelt on the unsuitability of the quarters, clothing, food, etc., of the detached enlisted men. Suggestions for improvement were promptly carried out as far as practicable, but in order to cover the important matter of suitable care of the men, the Chief Signal Officer of the Army inspected the Alaskan system during the past summer, visiting personally 24 stations, principally in the valleys of the Tanana and the Yukon.

He was thus able to pass intelligently upon all matters pertaining to the proper care of the enlisted men serving at detached stations. It is pleasant to report that he has had the fullest cooperation in remedying defects found, not only on the part of Brig. Gen. Constant Williams, commanding the Department of the Columbia, and his staff, but also from the Secretary of War, the Acting Chief of Staff, and bureau chiefs.

The most defective of the buildings, such as those at St. Michael, Safety Harbor, Koyukuk, Nulato, Birches, Baker, Cosna, and Goodpaster, are in process of repair or reconstruction, the sites being changed in some instances. It is probable that the sum of \$15,000 if judiciously spent another year will amply provide for all other stations.

The Surgeon-General of the Army has arranged for a small medical box at each detached station; the Chief of Ordnance has provided shot-guns, with ammunition, for use in securing game; and the Quartermaster-General ordered suitable special supplies.

The question of food is a very difficult one to correct, beyond furnishing shotguns for game, as has already been done. One station is said to have been eleven months without fresh meat, and but very few of the 37 repair stations can be provided with fresh meat at any season of the year, although it is furnished seven days out of ten to men serving at Alaskan military posts.

To offset fresh meat there had been previously authorized a small extra allowance of butter, milk, and sirup to men when serving in detachments of two. This, however, was a practical denial to the whole force, since safety demanded three men at a station. On the urgent telegraphic representations of the Chief Signal Officer of the Army, pointing out that at least one man was suffering from scurvy, the extra allowance of butter, milk, and sirup was authorized this autumn to three men serving together, but unfortunately denied to four men.

It is to be regretted that sufficient officers are not available for the annual inspection of all telegraph stations in Alaska, there being about 600 miles of line which has not been visited by any officer of the Signal Corps for the past two years; but there is a limit to the amount of work which any single officer can do.

#### RECONSTRUCTION.

The serious illness of the officer in charge of the Yukon and Tanana districts, and the prolonged interruptions in these sections, made it advisable for the Chief Signal Officer of the Army to extend his per-

sonal inspection of the system to the Tanana Valley. While the presence of an experienced officer would have perhaps sooner restored communication over this section, it is unquestioned that prolonged interruptions must have resulted from the extensive forest fires in the upper Tanana watershed and unprecedented floods in the lower valley which washed away repair cabins and occasionally portions of the telegraph line.

The process of replacing a few telegraph poles is easy in the United States, but in remote districts of Alaska, without inhabitants, without trails, and without transportation save by water, the task of replacing a mile of line is extremely difficult. The two repairmen carry not only their repair tools, but also their tentage, bedding, food, and cooking utensils. After poles are cut they must be carried on their shoulders through dense thickets, and heavy coils of wire must be dragged or rolled through a pathless region.

The subject of preventive repairs was thoroughly and personally investigated by the Chief Signal Officer of the Army, who has taken such steps as will greatly mitigate and almost entirely remove interruptions another summer. Strangely enough the summer is the most difficult time for repairs and maintenance.

The condition of affairs in the upper Tanana has been gradually improved by general repairs from Ketchumstock to Goodpaster. As Goodpaster station was burned, it was found to be in the public interests to remove to McCarthy station, at Big Delta River, on the south side of the Tanana, where the mail route, the miners' trail, and the work of the Alaskan road commission meet, thus making the cooperation of the Signal Corps most advisable in the general interests.

An additional station has been ordered built at Little Delta, on the south side of the Tanana, for permanent occupation, and arrangements made to open annually three temporary summer repair stations near Tolavana, Nenana, and Hot Springs, which will make the longest summer repair section 28 miles.

The summer conditions of the lower Tanana make the efficient maintenance of the line from Baker to Fort Gibbon impossible save in very favorable years. This line is therefore to be abandoned, Baker being removed a few miles to Hot Springs. The old, temporary, and abandoned line from Rampart to Gibbon is to be rebuilt along the Yukon. The placing of this section on high ground, through a somewhat settled country, as against a trackless, uninhabited region must materially improve the summer service. These changes are in process of completion.

#### WIRELESS SECTION.

In August, 1903, a wireless section of 107 miles across Norton Sound was established through the professional skill and exceptional ability of Capt. Leonard D. Wildman, Signal Corps. This is the only long wireless telegraph system in the world, it is believed, that is regularly operated as a part of a telegraph system handling commercial business. On August 6, 1904, it completed a year of uninterrupted service over its course of 107 miles. It has handled daily and uninterruptedly the entire telegraphic business of Nome and the Seward Peninsula, which, together with the official business, averages several thousand words daily. More than a million words were sent during the year, many thousand being commercial code words in which no error has ever been traced to this section. In a single hour there have

been transmitted over this section 2,000 words without error or repetition. The successful installation and operation of this unique work by the officers and soldiers of the American Army afford an added illustration of their intelligence and aptitude.

Captain Wildman, at his own request, was retained at Nome throughout an arctic winter, so as to insure continuity of operation and the successful training of the enlisted force. This action was fortunate, as an unexpected destruction of Leyden jars threatened the interruption of the line, but the situation was saved by Captain Wildman's resourcefulness in construction and substituting air condensers. In addition to his ingenuity in original installation, Captain Wildman has invented a new receiver, which is simple, inexpensive, and efficient.

Of this service Major Glassford says:

Captain Wildman remained in charge of the wireless installations, and through his technical ability, energy, and resourcefulness, and ably assisted by the enlisted men of the Signal Corps under him, each of whom took a personal interest and pride in his work, the wireless system in operation between St. Michael and Safety Harbor has the proud distinction of over (now thirteen) ten months of continuous uninterrupted service.

Of the work of the enlisted men at these stations Captain Wildman has practiced making the men rely upon themselves for all minor defects, and to call upon him only when they had exhausted their own resources. In but two cases has he been called upon to suggest remedies. This is a remarkable instance of the ingenuity and adaptability of the better class of men in the Signal Corps. Captain Wildman frankly admits that in several instances their way of making repairs was better than his original way of designing the parts, and also acknowledges his indebtedness to every man in the two plants for suggestions. Two large commercial companies doing business in that section state that since the wireless has been established not a single code word in their messages has been incorrectly received.

The wireless work was done by an alternate current, 500 volts, 60 cycle, 3 kilowatt generator; a 6-horsepower gasoline, single cylinder engine, with special governor; a small grid at masthead with only two connecting wires, and large ground capacity.

The dynamos, built according to Wildman's plans, were provided with specially heavy insulation about the armature coils and collector rings. The switchboards were of home manufacture.

Electric storms gave little trouble, and weather or ice conditions had no material influence. The receiver was of the De Forest type, modified by signal corps inventions. Captain Wildman found many opportunities for the resourceful minds of himself and his subordinates. Broken Leyden jars were successfully replaced by air condensers, the spark was muffled, currents shunted, and many other improvements applied. Captain Wildman thinks duplexing possible to a certain extent, and a call-up device probable. The efficiency of the service is largely attributed by him to the ingenuity and resourcefulness of his subordinates, Sergeants Harper, Munroe, Treffinger, Wilson, and McKinney being especially commended. The last named devised a key that increased the sending capacity from 15 to 30 words per minute.

At St. Michael water was only obtainable from melted ice for nine months of the year, but at Safety a well sunk in the house furnished brackish water for operation.

The engines, dynamos, and other important apparatus were duplicated, owing to the fact that Nome is accessible but three months each year. Of this precaution Captain Wildman says:

The wisdom of this duplication is shown by the fact that, during the nine months of operation completed this day, not a single hour has been lost from any cause whatever. If, however, two engines had not been available, there would have been

three occasions when a delay of from twenty-four to forty-eight hours would have been unavoidable.

The first accident occurred on January 25, when a part of the roof of the engine house was blown off, filling the room with snow and putting out the fire in the stove. The water jacket surrounding the cylinder froze before it could be emptied, and cracked the cylinder. This occurred at 4 o'clock in the morning while the men were asleep, and at 9 o'clock that morning, at the usual hour for opening the office, a temporary roof had been constructed, the snow drifts cleaned out, the dynamos dried, and the spare engine connected up.

The second accident occurred in February, when the belt broke during the sending hour, ripping out all the pipe connections and putting the engine out of line. The other engine was started within two minutes and the service was not interrupted.

The third accident occurred in March, and was caused by cracking the spark plug. While this would have necessitated shutting down for only an hour, that short delay was avoided by the fact that the other engine was in readiness.

The astonishing success of this system is due to the ingenuity, application, and prevision of Capt. L. D. Wildman, Signal Corps. While his preliminary experimental work in Long Island Sound, mentioned in last year's report, forecast success in Alaska, it is possible that the system would have broken down from minor causes had he not voluntarily urged, to his personal discomfort, the necessity of his remaining in Alaska for the winter instead of returning to San Francisco, as his orders required.

Captain Wildman's report is full of valuable data bearing on the work at St. Michael in particular and on wireless telegraphy in general.

Observation and experiments made by Captain Wildman indicate the impracticability, in the present stage of wireless telegraphy, of the suggested plan of connecting St. Michael and Valdes by three intervening wireless stations. This also tends to the opinion long since advanced by the Chief Signal Officer of the Army on limitations of wireless systems apart from the element of distance alone.

#### TELEGRAPH RATES.

During the year the tariffs for Alaskan messages have been subject to criticism and subjected to a thorough examination and consideration. The questions considered were technical and complicated, involving cable systems, land lines, wireless sections, and enormous distances of intervening uninhabited areas between paying stations.

A thorough examination of the subject led to a confirmation by the President of the tariffs fixed by the Chief Signal Officer of the Army. The tariffs over the cables were far lower than obtained elsewhere in the world over lines similarly situated, and the land rates were about one-fifth of those obtaining on the 500 miles of commercial lines, telegraph and telephone, in Alaska. At 7 stations, handling 90 per cent of the Alaskan business, the charges on messages handled via Canadian lines were 143 per cent greater in 1904 than those fixed by the Chief Signal Officer of the Army for messages transmitted over the Signal Corps cable.

The prospect that tariffs approximating \$80,000 per annum would be deposited in the Treasury of the United States gave the impression that the cable was being made a paying investment, when, as a matter of fact, the cost of operation and maintenance is, and probably will be for years, greater than the receipts. Reductions will be made from time to time as business increases and conditions demand.

With a view, however, of serving to the greatest possible extent the interests of the Territory and to bring Alaskan daily life more in con-

tact with national affairs, the Chief Signal Officer of the Army reduced the press rates to a nominal figure, as follows: To southeastern Alaska,  $1\frac{1}{2}$  cents per word; to Copper River country, 2 cents per word; to Tanana and Yukon valleys,  $2\frac{1}{2}$  cents per word, and to the Nome region, 3 cents per word.

It is interesting to note that under this liberal treatment the important news of the United States, and indeed of the world, conveyed from Seattle by cable, reaches Nome as a wireless message sometimes at 6 p. m., owing to six hours' advantage in time to the westward.

To stimulate domestic messages, a rate was fixed transmitting messages on domestic affairs between any two land stations in Alaska at a tariff of 50 cents per 10 words or \$1 for 25 words. The same tariff applies to domestic messages handled by wire to Valdes, and thence in and out of Alaska by mail. Several hundred domestic messages have thus been handled, and an increase is expected.

#### ALASKAN TELEGRAPH BUSINESS.

During the year there were handled 134,630 messages. The pecuniary value of telegraphic work of the Signal Corps in Alaska is indicated by the tariffs on the messages handled, which, if paid for at commercial rates, would aggregate the sum of \$175,488.29, divided as follows: Official messages sent by different Departments of the United States Governments, \$71,349.28; commercial messages, \$104,139.01.

All official business of the various Departments of the National Government is, however, transmitted free. The tariffs on the commercial messages are divided as follows: "This line" receipts, which have been deposited in the Treasury of the United States, as the law requires, \$78,015.44; "Other line" receipts, being the tariffs pertaining to the transmission of messages over commercial lines, which have been transferred to the officials of the commercial telegraph lines to which they belong, namely, the Canadian government system, the White Pass and Yukon Railway Company, the Postal Telegraph-Cable Company, and the Western Union Telegraph Company, \$26,123.

In addition to this there has been excluded from this circulation all official messages relating to the Signal Corps, and a very large amount of free business, on which the tariffs, if calculated, would exceed \$90,000. The free business consists of military news bulletins, notifications regarding the progress and interruption of mails, the transmission of river reports, weather data, and other like information.

It was deemed proper to relieve the isolation of Alaskan life by furnishing daily the approved news bulletin to each military post and station, and by granting a strictly limited use of the line in intercommunication on social subjects between the different military stations.

It is estimated that the value of the tariffs for the coming year will be about as follows: Other lines, \$40,000; this line, \$110,000; official business, \$100,000; in all, about \$250,000, of which \$150,000 will be in cash and the other the value of Government business.

It is renewed evidence of the high character of the enlisted men of the Signal Corps that although most of the men in Alaska handle money received for telegraph tariffs, there was during the year but one case in which a shortage was reported, and in this the entire amount was recovered. To include July 1, 1905, nearly \$200,000 has been received and accounted for by the enlisted men of the Corps and

not a single dollar has been lost to the United States. That the amounts handled are neither unimportant nor inconsiderable is shown by the fact that in a single year one sergeant received and accounted for \$10,237.58.

#### LAND LINES EXTENSION.

No extension of land lines seems necessary. The needs of the Tanana mining camps near Fairbanks are met by a local telephone service of 75 miles and 120 stations, built and maintained by private enterprise.

#### FUTURE DISPOSITIONS.

The Chief Signal Officer of the Army recommends for the Alaskan telegraph system the policy of gradual abandonment of the land lines as the future development of Alaska and the coincident extension of private enterprises may render possible. At present no private corporation could efficiently maintain and operate the land lines. They are maintained by men receiving from \$13 to \$54, with rations, in a country where day laborers earn from \$4.50 to \$10 per day (in some cases with board) and skilled laborers from \$10 to \$15 per day. Only loyalty to his oath of enlistment keeps the American soldier on this arduous, dangerous, and monotonous duty.

Civilians hired by the Signal Corps in Alaska abandon their contracts the moment more profitable service is offered, and desert in crowds when gold strikes are reported.

The sale or transfer of the line must inevitably be accompanied by higher tariffs, but the policy of abandonment and transfer is thought to be in the best interests of the Government.

The very extensive interests of Seward Peninsula, in the Nome region, are efficiently served by a telephone service 416 miles in length and having about 200 phones, which is most efficient in operation and reliability.

If the mining interests of the upper Koyukuk should very materially improve there might be a local demand for a telephone or telegraph line from Rampart to Bettles, but such necessity does not now exist.

#### DIVISION OF THE PHILIPPINES.

The military system of land lines and cables in the Division of the Philippines has been in charge for the greater part of the year of Lieut. Col. R. E. Thompson, Signal Corps, who, in addition to this work, has performed the other duties of chief signal officer, Philippines Division. The system has remained substantially unchanged during the year. One hundred and fifty miles of land lines were transferred to the civil government, 38 miles of new lines were constructed, and 332 miles reconstructed. Four very short cables, aggregating less than 15 miles, were abandoned during the year; and one new cable laid, 17 miles long, across Lake Lanao, connecting Camps Overton and Keithley.

On June 30 the military system consisted of 3,195.5 miles of line, of which 1,405.75 miles were land lines, 1,451.8 miles were submarine cable, and 337.9 miles were telephone lines. The Philippine civil government has a system of 4,774.7 miles, of which 2,266.75 miles are land lines, 2,338.75 miles telephone lines, and 169.22 miles cables. The total mileage, military and civil, is 7,970.2.

There were handled by the military lines during the year 1,033,840 messages, a falling off of 11 per cent from 1904, due largely to cable

interruptions, which, through lack of a cable steamer for repairs, entailed the use of the expensive Eastern Extension lines.

The tariff values for the year aggregated \$475,164.60, as follows: United States messages, \$272,136.51; telegraph business of the Philippine government, \$142,989.31; commercial tolls, \$60,038.78. In addition, the tariffs at 10 cents per message on the official dispatches sent over the Manila military telephone system would equal \$37,239 additional, making an aggregate of \$512,403.60. The land lines have been maintained in very efficient condition, and reconstruction is largely on iron poles. The army operates 82 telegraph and 11 telephone stations, while the insular government has 86 telegraph and 214 telephone stations.

Apart from the Manila telephone system there have been operated at military posts 27 telephone systems, 124.4 miles in length, having 268 telephones.

The following telegraph lines were transferred to the civil government: Cagayan to beach, 3 miles; Boac to beach, 7 miles; Manila to Dugupan, line No. 10, 150 miles; in all, 160 miles. The estimated value of the lines was \$6,423.50, while signal corps property was transferred to the value of \$2,402.65. It should be said that these lines, arbitrarily valued as above, would not be worth to the United States the cost of their recovery.

The operating force on June 30 consisted of 10 officers and 367 enlisted men (three companies) of the Signal Corps, and 181 civilian employees, of whom 177 general laborers, repair men, and messengers, of very small salary, were paid from the civil funds allotted by the Philippine government.

The plan of relieving the Signal Corps by companies after service of two years has been perfected, the third and last company being now under orders. A company sails each eight months, thus insuring constantly an experienced force of two-thirds. Only one man died of disease, a second died at Honolulu en route to Manila, and two men were accidentally drowned. There were no desertions.

The chief signal officer of the division making no remarks or recommendations regarding the force or work, they are assumed to be satisfactory to the commanding general.

The following pertinent extracts are from subordinate reports:

Lieutenant Beacham, in charge of the Manila telephone station, says:

The Manila telephone system consists of three exchanges—the military central, operated day and night; the division and quartermaster's subexchanges, operated eight and one-half hours daily. Over the 190 telephones there have been 372,394 calls.

It is a thorough up-to-date system of 219 miles, 66 per cent consisting of modern aerial cables.

This system, which occupies 26 men, should be replaced by a civil system.

The chief signal officer believes that the installation of an efficient civil telephone service, from which instruments could be rented by the Army, would be in the economical interests of both the civil and military establishments.

#### RECONSTRUCTION AND REPAIRS.

Capt. H. W. Stamford, chief signal officer, Department of Luzon, reports:

Reconstruction of the two lines running south from Santo Tomas, province of Batangas, to Guinayangan, province of Tayabas, has been continued. This work



consisted of thoroughly rebuilding the line with iron telegraph poles, excepting in certain mountainous sections, where it was physically impossible, owing to the topography of the country, to transport this class of material, the roads and trails being in such bad condition that it necessarily made the work most difficult. However, it was successfully carried to completion under the supervision of First Lieut. Joseph W. Beacham, jr., Signal Corps.

Captain Carr, chief signal officer, Department of the Visayas, says:

The few and brief interruptions of communication bear testimony to the care and faithfulness with which the enlisted men of the Signal Corps and the native linemen performed their arduous and at times dangerous duties.

When it is understood that until within the past few months enlisted men of the Signal Corps on duty as linemen were required to cover their districts afoot in terrific heats and torrential rains, the hardships of their work may be better appreciated. The district sergeant at Jaro, charged with the maintenance of 62 miles of line, was obliged to walk this distance.

Of conditions in Mindanao, Major Greene reports as follows:

The land line from Tucuran to Lintogoup, 20 miles long, was formerly so difficult of travel that a lineman after making the round trip was a fit subject for hospital treatment. Lieut. O. B. Grimm, Signal Corps, built several bridges and cleared out the line, which greatly reduces labor and hardships.

While malicious interference and attacks on linemen have very materially lessened, yet Major Greene says that—

Intentional damage to the lines by hostiles and malcontents has occurred several times, noticeably on August 19, 1904, when the line was cut by hostiles near Reina Regente, and 2 Moro linemen engaged in reconstruction killed by the hostiles.

Line cutting near Cudarangan became frequent, until on December 22 the lineman's escort of 20 men ran into a line-cutting party and killed 4 of them, after which trouble was much less frequent.

That conditions are not always quiet in Mindanao, Major Greene shows:

In the Rio Grande Valley and between Malabang and Camp Vicars, as a general rule, native Moro linemen can patrol the line alone in safety, being turned back when American linemen, unless under strong escort, would be attacked.

#### PHILIPPINE CABLE SYSTEM.

The military cable system in the Philippine Archipelago was initiated under war conditions, the cables being of the lightest type possible, and originally planned to last only five years. They were laid largely in unsurveyed waters and over coral beds, which the necessities of the case and the lack of funds required. Despite these facts the system has proved more efficient than was thought possible. There are now 34 cables in operation, including those of the civil government.

The interruptions to military cables have been about one for every three years of cable life in the less favorable environment of the army cables, as against one for every four years in the Eastern Extension system. It appears that a large percentage of interruptions have occurred in the shallow waters of Mindanao and the Sulu Archipelago, where the unfavorable coral bottoms can not possibly be avoided in whole, although they could in part. On this point Major Greene pertinently says:

Some causes of disaster may be removed by extended soundings and relocations of new cables in deeper water, but others can not be avoided; the approaches to the landings for long distances being over coral, which, with the action of the tides, acts as an ever present and working file.

Despite the insistence of the Chief Signal Officer of the Army, and the directions of the Secretary of War that the cable system should be

maintained efficiently, the Signal Corps was without proper transportation during almost the entire year for deep-sea operations. It was also officially reported that seventeen days elapsed before transportation was furnished to repair a lake cable.

It was not until April, 1905, that a cable ship, the *Liscum*, was provided for signal-corps work. Under the direction of First Lieut. James S. Butler, Signal Corps, in charge of the *Liscum*, such efficient work was done as has restored every signal-corps cable except that between Jolo and Zamboanga, for which cable material is lacking. The cost of the *Liscum* is about \$13,500 per month, while she is still available to carry passengers and freight.

If efficient cable service is to be maintained in the Philippines the *Liscum* must be kept available as a cable ship, and considerable money spent each year in the purchase of new cables.

#### ENLISTED MEN.

The same qualities of ability, fidelity, and courage which have marked the service of the enlisted men in the Philippines during previous years have been continued. Their physical wants are being better guarded than in previous years, and changes of station relieve the monotony of life at certain stations.

The most striking service by a signal corps man during the year was doubtless that of Corpl. Edwin Myers, of which Major Greene says:

On May 11, 1905, at 1 a. m., at Siasi, which is garrisoned by a company of Moro constabulary, a sentry murdered the commanding officer while asleep. The signal-corps operator, Corpl. Edwin Myers, at once assumed command of the company and held them for twenty-four hours until the arrival of an officer. He probably saved the command from going to pieces.

This service was recognized by the Chief Signal Officer of the Army in an order promoting Corporal Myers to the position of first-class sergeant.

The inconsiderate and extravagant use of the telegraph lines imposes at times extra hours and hardships upon the men of the Signal Corps. This, however, is not confined to the Philippines alone. On this point Major Greene reports:

On account of the infrequent and irregular mail service in this department, the great number of persons who have the privilege of free official telegraphing, and the natural inclination to use the easiest means of communication, the telegraph line is overloaded. Through very long hours, averaging twelve hours daily, and at relay stations (this includes Sundays and holidays), this causes actual and unnecessary hardship to the signal-corps operators. There is no practical remedy for this state of affairs, for although orders, military and civil, forbidding use of the telegraph when the mail would answer, and cautioning against the use of any but the barest number of words to convey the meaning, are in existence, it would appear that little heed is paid to them.

#### TRANSFER OF LINES.

The transfer of the telegraph system to civil authorities progresses steadily, though very slowly. The civil government has been unceasing in its cooperation with the Signal Corps in maintaining this system of intercommunication, which is indispensable not only to the prosperity but to the successful government of the Philippines. Allotments for the purchase of additional cable, and the maintenance of smaller offices not absolutely essential for military purposes, have been made by the civil government, which appropriates for this purpose

the amount of commercial tariffs, which are turned in to the insular treasury.

Altogether, harmony and cooperation have marked the relations of the civil and military services during the past year. A map showing the limitations of each system is inclosed.

#### VISUAL SIGNALING.

On this subject, Capt. Daniel J. Carr, chief signal officer Department of Visayas, says:

Practical use of visual signaling was made between the military forces at Camp Connell and Tarangnan, Samar, about 10 miles. Heliographs were used until April last, when two field acetylene lanterns were issued, so that communication could be established nightly. Clouds rendered the heliograph only intermittently available, and the lanterns, therefore, serve a very useful purpose.

From the temporary headquarters of the commanding general of the department on board the U. S. C. T. *Carmen*, the transaction of business was facilitated by visual signaling conducted by the Signal Corps with the naval boats assisting in the pacification of eastern Samar.

The simpler visual signaling appliances have been issued to separate units of the civil forces operating in the field, and it is understood that valuable use has been made of them.

Major Greene, chief signal officer Department of Mindanao, adds:

The instruction of the line of the Army in visual signaling required by Army Regulations, paragraph 1594, has not been effective, many organizations falling short of the requirements.

#### UNITED STATES.

The operations in the United States include the fire-control and fire-direction systems of the coast and field artillery; the equipment of rifle ranges; the management of military telegraph lines; the establishment of post telephone exchanges; the signaling equipment of the National Guard; ballooning work; preparation of manuals, and the training of recruits in visual, electrical, and telephonic work, and especially in suitable provisional methods for active and efficient work in case of war or other emergency.

Except as to military ballooning, the duties of the Signal Corps have been as satisfactorily and efficiently performed as the limited force and the appropriations would permit.

#### ORGANIZATION OF THE SIGNAL CORPS.

The following officers were serving in the Signal Corps on September 30:

No.	Name and rank.	Stations and duties. (Foreign service since appointment as regular officer.)	At present station since—	Born.
1	<i>Chief Signal Officer, Brigadier-General.</i> ADOLPHUS W. GREELY .....	Washington, D. C. .... Foreign service (inspection duty in Alaska, Cuba, and the Philippines), one year and one month.	.....	Mar. 27, 1844
1	<i>Colonel.</i> James Allen .....	Assistant to Chief Signal Officer, Washington, D. C. Foreign service in Alaska, Cuba, Porto Rico, and the Philippines, two years seven months and six days.	Oct. 24, 1904	Feb. 13, 1849

No.	Name and rank.	Stations and duties. (Foreign service since appointment as regular officer.)	At present station since—	Born.
<i>Lieutenant-Colonels.</i>				
1	Richard E. Thompson.....	Chief signal officer Philippines Division, Manila, P. I. Foreign service in the Philippines, two years three months and five days.	Nov. 30, 1904	Jan. 18, 1848
2	George P. Scriven .....	Chief signal officer Department of the East, Army Building, New York City. Foreign service in China, Cuba, and the Philippines, one year eleven months and sixteen days.	Dec. 14, 1904	Feb. 21, 1854
<i>Majors.</i>				
1	William A. Glassford.....	Chief signal officer Department of the Columbia, Seattle, Wash. Foreign service in Alaska, Porto Rico, and the Philippines, four years eight months and twelve days.	Oct. 18, 1904	Apr. 11, 1853
2	Frank Greene .....	Chief signal officer Department of Mindanao, Zamboanga, P. I. Foreign service in Alaska, Cuba, and the Philippines, four years six months and thirteen days.	Mar. 11, 1905	Mar. 16, 1849
3	Samuel Reber.....	Washington, D. C.; on duty with the General Staff. Foreign service in Cuba and Porto Rico, ten months and sixteen days.	Aug. 15, 1903	Oct. 16, 1864
4	George O. Squier.....	Assistant commandant of the Signal School at Fort Leavenworth, Kans. Foreign service in the Philippines, two years two months and twenty-six days.	Aug. 5, 1905	Mar. 21, 1865
5	Edgar Russel.....	Office Chief Signal Officer, Washington, D. C. Foreign service in Alaska and the Philippines, three years and twenty days.	Jan. 4, 1904	Feb. 20, 1862
6	Eugene O. Fechét.....	Chief signal officer Department of the Missouri, and commanding officer Fort Omaha, Nebr. Foreign service in the Philippines, two years one month and twenty-nine days.	Sept. 18, 1905	Mar. 14, 1846
<i>Captains.</i>				
1	Charles McK. Saltzman....	Student at the Signal School at Fort Leavenworth, Kans. Foreign service in Cuba and the Philippines, two years nine months and eight days.	Aug. 15, 1905	Oct. 18, 1871
2	Benjamin F. Montgomery..	Benicia Barracks, Cal.....	May 14, 1905	July 5, 1853
3	Daniel J. Carr .....	Chief signal officer Department of the Visayas, Iloilo, P. I. Foreign service in the Philippines, seven months.	Mar. 15, 1905	Nov. 25, 1860
4	Carl F. Hartmann .....	Valdez, Alaska..... Foreign service in the Philippines, two years two months and twenty-eight days.	Sept. —, 1905	Jan. 17, 1868
5	George C. Burnell .....	Commanding officer, Fort Wood, N. Y. Foreign service in Alaska, two years three months and twenty-seven days.	Feb. 25, 1904	July 5, 1868
6	Leonard D. Wildman.....	Chief signal officer Department of California, San Francisco, Cal. Foreign service in Alaska and the Philippines, two years four months and twenty-eight days.	Sept. 1, 1905	Oct. 13, 1868
7	Charles B. Hepburn .....	Manila, P. I. .... Foreign service in the Philippines, seven months and eighteen days.	Oct. 29, 1904	Aug. 14, 1868

# 22 ANNUAL REPORT CHIEF SIGNAL OFFICER, U. S. ARMY.

No.	Name and rank.	Stations and duties. (Foreign service since appointment as regular officer.)	At present station since—	Born.
<i>Captains—Continued.</i>				
8	Otto A. Nesmith .....	Commanding signal corps company at Fort Omaha, Nebr. Foreign service in Alaska and Cuba, three years one month and twenty days.	Sept. 19, 1905	Mar. 7, 1852
9	Walter L. Clarke .....	Commanding officer Benicia Barracks, Cal. Foreign service in Alaska and the Philippines, two years one month and fifteen days.	Apr. 17, 1905	Mar. 10, 1863
10	Basil O. Lenoir .....	Assistant to the chief signal officer Department of the East, Army Building, New York City; commanding officer U. S. cable boat Cyrus W. Field since October 16, 1904. Foreign service in the Philippines, one year and three months.	Dec. 8, 1903	Nov. 12, 1858
11	William Mitchell .....	Commanding signal corps company at Fort Leavenworth, Kans. Foreign service in Alaska, one year eight months and eighteen days.	Oct. 18, 1904	Dec. 29, 1879
12	Henry W. Stamford .....	Chief signal officer Department of Luzon, Manila, P. I. Foreign service in China and the Philippines, one year eleven months and two days.	Apr. 28, 1905	Mar. 19, 1866
13	Charles S. Wallace .....	Seattle, Wash.; commanding officer transport Burnside, serving as cable-ship for Signal Corps in Alaskan waters, pertaining to the installation of the Alaskan cable. Foreign service in Alaska and the Philippines, two years seven months and ten days.	May 6 1904	Sept. 11, 1866
14	George S. Gibbs .....	Disbursing officer, Signal Corps, Washington, D. C. Foreign service in Alaska, two years and twenty days.	Feb. 19, 1904	Dec. 14, 1875
15	Charles DeF. Chandler .....	Office Chief Signal Officer, Washington, D. C. Foreign service in Alaska and the Philippines, two years three months and seven days.	Feb. 1, 1905	Dec. 24, 1878
16	Henry S. Hathaway .....	Fort Omaha, Nebr. .... Foreign service in the Philippines, one year two months and nine days.	Oct. —, 1905	July 6, 1872
17	Richard O. Rickard .....	Student at the Signal School at Fort Leavenworth, Kans. Foreign service in Alaska and the Philippines, one year ten months and sixteen days.	Oct. 29, 1904	July 15, 1874
18	Mack K. Cunningham .....	Student at the Signal School at Fort Leavenworth, Kans. Foreign service in the Philippines, two years four months and seventeen days.	Aug. 15, 1905	Feb. 14, 1870
<i>First Lieutenants.</i>				
1	Reginald E. McNally <sup>a</sup> .....	On duty with signal corps company at Fort Leavenworth, Kans. Foreign service in the Philippines, two years eight months and twenty-two days.	Sept. 17, 1905	Nov. 27, 1877
2	Joseph W. Beacham, jr. <sup>a</sup> .....	Manila, P. I. .... Foreign service in the Philippines, two years seven months and six days.	May 11, 1904	Apr. 8, 1878
3	William A. Kent <sup>a</sup> .....	Fort Wood, N. Y. .... Foreign service in the Philippines, three years one month and twenty-four days.	Feb. 6, 1905	Nov. 22, 1874

<sup>a</sup> First lieutenant, Signal Corps, by detail under act of Congress approved March 2, 1903.

No.	Name and rank.	Stations and duties. (Foreign service since appointment as regular officer.)	At present station since—	Born.
<i>First Lieutenants—Cont'd.</i>				
4	Lawrence P. Butler <sup>a</sup> .....	Commanding signal corps company at Fort Omaha, Nebr. Foreign service in the Philippines, one year and eleven months.	Sept. 12, 1905	Jan. 23, 1868
5	Alfred T. Clifton .....	Benicia Barracks, Cal. .... Foreign service in Alaska and the Philippines, one year one month and twenty-nine days.	Mar. 20, 1905	May 26, 1875
6	Otto B. Grimm.....	Hilo, P. I. .... Foreign service in Alaska and the Philippines, three years nine months and twenty-seven days.	July 29, 1905	Nov. 30, 1873
7	Frederick L. Buck <sup>a</sup> .....	Fort Wood, N. Y. .... On two months' leave of absence since July 6, per par. 12, Special Orders, No. 133, War Department, Washington, June 9, 1905.	Sept. 7, 1905	Aug. 29, 1875
8	William A. Covington <sup>a</sup> .....	Chief signal officer Department of the Gulf, Atlanta, Ga.	Mar. 26, 1905	June 7, 1873
9	Alvin C. Voris <sup>a</sup> .....	St. Michael, Alaska. .... Foreign service in the Philippines, three months and five days.	Sept., 1905	Jan. 5, 1876
10	George E. Kumpe <sup>a</sup> .....	Benicia Barracks, Cal. .... Foreign service in the Philippines, one year three months and ten days.	June 17, 1904	May 12, 1876
11	Gordon Johnston <sup>a</sup> .....	Assistant to chief signal officer, Department of Mindanao, Zamboanga, P. I. .... Foreign service in Cuba and the Philippines, one year four months and seven days.	May 9, 1905	May 25, 1874
12	E. Alexis Jeunet <sup>a</sup> .....	Signal corps depot, Fort Myer, Va. .... Foreign service in the Philippines, eight months and four days.	July 3, 1905	Mar. 1, 1872
13	John E. Hemphill <sup>a</sup> .....	Fort Gibbon, Alaska. .... Foreign service in Alaska and the Philippines, two years two months and sixteen days.	Sept., 1905	June 4, 1867
14	William M. Goodale <sup>a</sup> .....	Benicia Barracks, Cal. .... Foreign service in the Philippines, eight months.	Feb. 2, 1904	Jan. 19, 1872
15	Allan L. Briggs <sup>a</sup> .....	Manila, P. I.; disbursing officer and acting quartermaster and commissary, Signal Corps, in Philippines, since July 1, 1905. Foreign service in the Philippines, seven months.	Mar. 2, 1905	Feb. 14, 1873
16	James S. Butler <sup>a</sup> .....	Manila, P. I.; in charge of cable operations on U. S. A. T. "Liscum" in Philippines, since Jan. 10, 1905. Foreign service in the Philippines, one year and two days.	Nov. 30, 1904	Nov. 19, 1877
17	William C. Fitzpatrick <sup>a</sup> ....	U. S. General Hospital, Fort Bayard, N. Mex., under medical treatment. Foreign service in Alaska, one year eleven months and two days.	July, 1905	June 6, 1876
18	Vacancy <sup>b</sup> .....			

<sup>a</sup> First lieutenant, Signal Corps, by detail under act of Congress approved March 2, 1903.<sup>b</sup> To be filled by detail from the line of the Army.

## STATIONS, AND DATES OF ARRIVAL AT, OF COMPANIES OF THE SIGNAL CORPS.

Company—	Station.	At stations since—
A.....	Fort Leavenworth, Kans.....	Oct. 18, 1904
B.....	Fort Omaha, Nebr.....	Sept. 12, 1905
C.....	Valdes, Alaska.....	Sept. —, 1905
D.....	Fort Omaha, Nebr.....	Sept. 19, 1905
E.....	Philippine Islands.....	May 28, 1899
Fa.....	Benicia Barracks, Cal.....	Jan. 15, 1905
G.....	Fort Wood, N. Y.....	Feb. 25, 1904
H.....	Benicia Barracks, Cal.....	Apr. 17, 1905
I.....	Philippine Islands.....	Oct. 29, 1904
K.....	Fort Gibbon, Alaska.....	Nov. 5, 1904
L.....	Philippine Islands.....	Mar. 2, 1905

a Under orders for duty in the Philippines.

The Signal Corps has an authorized strength of 1 brigadier-general, 1 colonel, 2 lieutenant-colonels, 6 majors, 18 captains, 18 first lieutenants, 36 master signal electricians, 132 first-class sergeants, 144 sergeants, 156 corporals, 552 first-class privates, 168 privates, and 24 cooks; in all, 46 officers and 1,212 enlisted men. Of these 15 officers are detailed from the line of the Army. There now exists 1 vacancy among the first lieutenantcies, caused by the retirement, from disability, of Maj. Joseph E. Maxfield, while the enlisted vacancies number 36.

In reorganizing the enlisted force of the Army the necessity of the Signal Corps for more officers should be recognized, as at least 5 additional officers are urgently needed. It is also urged that the discrimination against the Signal Corps in the way of rank be removed by giving the Corps a just proportion of field officers, it being at present 22 per cent the smallest of any staff corps. Under existing conditions the majority of the able and zealous officers of the Corps are prevented from obtaining promotion accorded to every other corps in the Army. It is extremely important that 1 colonel, and 1 lieutenant-colonel, 1 major, 2 captains, and 2 first lieutenants be added to the Corps. This would widen the field of selection for the position of Chief Signal Officer of the Army, now practically confined to a single colonel, and give a much needed flow of promotion. This would still leave the Signal Corps with the smallest percentage of field officers.

Important electrical work requires in commercial life ability of the highest character, which is correspondingly rewarded. If efficient service in time of war is expected from the Signal Corps, the rank and pay of its officers should not be inferior to those of every other corps.

The Chief Signal Officer of the Army has loyally endeavored to make a success of the detail system, now in its third year. As volunteers have failed conscription was necessary in the case of the sixteen officers already detailed, of whom fully one-fourth have endeavored to evade service through personal or political influence.

While knowing the ability of those officers in the line of the Army, the Chief Signal Officer can not, however, fail to recognize that only a moderate percentage have the aptitude and predilection which contribute so much to the efficiency of officers when on satisfactory duty. Practically branded, as some of these officers have been, as deserters from the line to the Signal Corps, although in reality conscripts, the outlook is unfavorable for that success in rotation of duty for which the Chief Signal Officer earnestly labors.

The detail system in many respects is valuable; in other ways it is not. It previously failed in the Signal Corps, where it was tried for twenty-five years. If the detail system continues, it is recommended that it be carried out to its logical conclusion under conditions which will make practical the important principles of selection and elimination.

It is therefore suggested that the entire commissioned force of the Army, excluding the permanent technical corps, be arranged in one lineal list below the grade of brigadier-general. Officers can then be assigned in the Army, as now in the Navy, to any duty in the service for which they are specially fitted, and relieved therefrom when no longer efficient in their work. Through a system of annual retirement a suitable flow of promotion and elimination by retirement, as is done in the Navy, of officers incompetent, either morally or professionally, would then be practicable, and thus materially improve the service. Distinguished services could then be rewarded, without marked discrimination against equally competent officers who have not had opportunities, through advancement by files, the recipient being an extra number confirmed by the Senate.

#### ENLISTED MEN.

The enlisted force, which aggregated 1,176 on June 30, 1905, has experienced the following changes: Enlisted and reenlisted, 598, of whom 431 were recruits; deserted, 52, being 4.4 per cent of the total force; died, 7, 0.6 per cent; discharged for disability, 10, 0.8 per cent. One was promoted to be second lieutenant of infantry, through competitive examination.

The difficulty in retaining enlisted men of intelligence and character, thoroughly suited for the most important duties in the Signal Corps, has been somewhat though not entirely obviated by the addition of the grade of master signal electrician. The Chief Signal Officer of the Army is filling this grade with men of such character and aptitude as will fit them for especially important duties in ballooning, dynamo work, telegraphy, telephony, cable splicing, cable laying, power plants, line inspecting, and other difficult work, technical and administrative. Of the 12 originally appointed by selection, 10 proved by examinations that they would have attained their grade by competition. Special and extraordinary ability along certain lines has caused the appointment of one or two others, subject to noncompetitive examinations. The fixed policy of the office is to fill vacancies through competitive examination of first-class sergeants whose service, habits, intelligence, and zeal merit their designation as candidates. About half of the examination is practical, a weight of 25 per cent being given to the candidate's official record alone.

War emergencies having caused the appointment of many first-class sergeants for special reasons, it develops that some are neither well grounded technically nor possessed of special administrative ability. To decline the continuance of warrants to those reenlisting would work an injustice, especially in view of past services on foreign stations. To raise the standard of first-class sergeants, orders have been issued confining such promotions to an eligible list formed from sergeants of good character and efficient service, who have demonstrated by non-competitive examinations suitable knowledge of the essentials of signal-corps work, their military record being given a weight of 25 per cent.



As doing things rather than knowing them is the glory of an army, extraordinary services in the field will, in the future as in the past, insure exceptional advancement to signal-corps men.

#### OFFICE OF THE CHIEF SIGNAL OFFICER.

The rapid development of the fire-control work of the Signal Corps has enlarged to an extraordinary degree the volume of business transacted in this office, where the War Department force consists of 5 officers and 23 employees, whose work as regards the coast defenses is supplemented by a clerical force paid from the fire control appropriations.

Special credit is due Col. James Allen, principal assistant; Maj. Edgar Russel, in charge of the electrical division; and Capt. George S. Gibbs, disbursing officer, for the unusual ability and resourcefulness displayed in the transaction of the overwhelming business with an inexperienced and scarcely adequate force.

Notwithstanding the adoption of approved business methods of transacting the immense volume of official papers in this office, it has been with the greatest difficulty that the records have been handled. It is lamentable that in the important work of the Signal Office it has been impracticable to detail a sufficient clerical force to make proper record of its official communications. During the year ending June 30, 1905, no less than 388,545 official papers have been acted upon, an increase of above 30,000 as compared with the preceding year.

The reorganization of the Signal Office into five divisions—administrative, disbursing, electrical, telegraph, and examining—has coordinated and harmonized its business methods. From time to time, as has been found possible, the simplest methods of transacting business, compatible with the public interests, have been adopted.

With very rare exceptions the clerical force has displayed intelligence, zeal, and fidelity, and it is doubted whether as large an amount of clerical work per man has been transacted in any other bureau. The office suffers, as it has in the past, from inexperience due to a constant change of force.

Owing to the inadequate salaries paid in this office, as compared with others, special difficulty has been experienced in keeping filled positions as stenographers at \$900, a salary barely above that of a messenger. During the past seven years, out of 80 employees there have been 57 resignations and transfers, 71 per cent of the whole force. Under these conditions it is believed to be in the public interests to recommend the addition of one clerk of class 3, there being none of this grade in the office; and if the two clerks at \$900 could have their compensation increased to \$1,000, the permanency of the force would be greatly increased.

For the high class of work required of clerks in the Bureau, who must possess more than ordinary ability, the compensation should be in accordance therewith.

#### ADMINISTRATIVE DIVISION.

The administrative division has charge of the routine work of the Signal Office—the mail, general office correspondence, the office files, muster rolls, reports, and all matters affecting the commissioned,

enlisted, and civilian force of the Signal Corps. This division, with an inadequate clerical force, has by assiduous and systematic effort of the chief clerk, George A. Warren, satisfactorily transacted its largely increased business.

## DISBURSING DIVISION.

This division is charged with the preparation of estimates for appropriations by Congress—accounts, requisitions, and transfers from appropriations, quotations, samples, and advertisements, abstracting bids, making awards, placing orders, inspection, shipment, invoicing and accounting of supplies, payment of accounts, collecting bills, and all other duties pertaining to disbursements. The duties of disbursing officer have been performed most efficiently and promptly by Capt. George S. Gibbs, whose report shows that in the regular inspection of his accounts no errors have been found during the year and no disallowances have been made by the Auditor for the War Department.

In urging a much needed increase in clerical force, the disbursing officer reports that his 6 clerks have handled 152,759 papers during the year. The work has been performed only by the unremitting attention of clerks to duty.

The following table shows the state and disposition of appropriations, aggregating \$1,306,273.36:

*Statement, 1905.*

Appropriation.	Disbursements in Washington.	Allotments. <sup>a</sup>	Cash in Treasury.	Total.
Signal Service of the Army, 1905.....	\$119,951.82	\$58,108.40	\$30,439.78	\$208,500.00
Coast artillery fire-control installation.....	144,450.06	67,183.92	288,366.02	500,000.00
Submarine cable:				
Valdez to Seward, Alaska.....	87,495.75	4,867.00	2,637.25	95,000.00
Washington to Alaska.....	299,466.39	22,113.61		321,580.00
Military telegraph and cable lines, Alaska.....	565.77		17,207.59	17,773.36
Total.....	651,929.79	152,272.93	338,650.64	1,142,853.36

<sup>a</sup> Allotted to disbursing officers in the Philippines, Alaska, and various military departments in the United States.

## TELEGRAPH DIVISION.

This division, now under charge of Capt. C. DeF. Chandler, exercises supervision over all means of electrical communications, except such as pertain to fire control, having charge of the operation, maintenance, and repair of United States Signal Corps telegraph, telephone, and cable lines, and the installations in target ranges. The post telegraph systems and telephone exchanges for administrative purposes impose, by their importance and extent, much work.

In this division is kept a card record pertaining to target ranges, post telephone systems, military telegraph lines in the United States, Alaska, and the Philippines, War Department telegraph codes, and other incidental matters.

The volume of new business caused by the increase of the Alaskan telegraph lines has been enormous, but by unremitting work of the clerks in charge it has been kept up to date.

For the year there were 1,412 requisitions received in this division, which, as a general rule, are forwarded to the respective supply depots on the same day on which they are received.

## EXAMINING DIVISION.

Here are examined all money and property returns pertaining to the Signal Corps of the Army. All money accounts have been examined and forwarded within the limit fixed by law and regulations. By great diligence and application, all property returns pertaining to the Signal Corps men serving in the United States and Alaska have been kept up to date in their examination. It has been impossible to reexamine the very large number of returns from the Philippines, which have been passed on in a preliminary manner by the auditing division in Manila. It is believed, however, that the scrutiny there given should be final. Certainly it is impracticable to reexamine them formally and fully in this office with the present force.

## ELECTRICAL DIVISION.

This division has charge of the electrical work of the Signal Corps, the selection of special and general apparatus and devices, of executive functions relative to electrical matters and fire control, and requisitions for electrical material and supplies, excepting such as pertain to the telegraph division. Although newly organized, it has, on account of the magnitude of the rapidly growing work, become one of the important divisions of the office and has handled a very large amount of business.

From July 1 to March 16 the office was under charge of Lieut. W. A. Covington, Signal Corps, and from the latter date until June 30, 1905, it was under Maj. Edgar Russel, Signal Corps, who have most efficiently performed their respective duties.

The general classes of work assigned to this division are:

1. Fire-control communications, coast artillery, and experimental fire-control service of field artillery.
2. General direction of the civilian engineers and electrical assistants engaged in various branches of electrical work and inspections.
3. Supervision and control of the test room and instrument maker's room.
4. Preparation of plans, drawings, and blueprints required for signal corps work.
5. Consideration of various technical questions, largely electrical, bearing on the improvement of signal corps work.

The efficiency of the division is due largely to the chief clerk, Mr. H. S. Flynn, who has had the assistance of a number of very capable clerks, and who met the unusually severe work of the office cheerfully.

The draftsmen's room, under Mr. William Welch, has turned out an enormous amount of work, necessitated by the large number of technical drawings required in preparing for the new equipments of the Signal Corps. The preparation of drawings for both the new manuals also occurred during the year. The character of all the work of the draftsmen has elicited the highest praise from all. Very few criticisms of the working drawings are received from manufacturers.

The signal corps test room has been very busily engaged in the numerous tests required to cover commercial orders now being placed for large quantities of materials for the Signal Corps. Before any of the numerous new devices are adopted, a thorough test is made of all the separate parts of the apparatus, an accurate decision reached

regarding dimensions, resistances of the coils, etc. Continuous tests are carried on as to the capabilities of different kinds of batteries, both storage and primary, and these tests alone will save thousands of dollars to the Government, in addition to insuring good service in place of bad at critical periods.

Adjacent to the signal corps test room is a large model room in which is installed a complete fire-control outfit, wherein is simulated a small fire command with instruments so set up and marked that the entire system can be readily comprehended and an exhibition be given of the fire command in active operation, as far as range finding and fire control is concerned. In addition to these instruments there are being assembled typical samples of all the electrical and visual equipments required by the Signal Corps.

Important and delicate models, on which experiments are to be made, have been constructed by Mr. Adolph Mayer, whose unsurpassed skill as an instrument maker and his intelligent cooperation have been of the greatest assistance.

The preparation of plans and drawings, as already stated, is under the control of the draftsmen's room. Adjacent to this is the blueprint room, where a very excellent electric blueprint machine is installed for printing the very large volume of blueprints, drawings, and maps now required by the Signal Corps. A large number of negatives of apparatus and maps are being collected, and a Cooper-Hewitt mercury vapor lamp for printing these has been installed.

In addition to the above work, various telegraph and telephone devices, in use by the Signal Corps in general, are constantly being considered. This is especially necessary in deciding upon the electrical problems connected with the field equipment of the Signal Corps, and thereby decisions have been reached as to the best patterns of field telephones and buzzers.

#### BOARD ON EQUIPMENT AND AWARDS.

In order to insure steady improvement in equipment and economical administration of the Signal Corps, there has been formed a Board on Award and Equipment. These officers examine all bids on Signal Corps material with a view to insuring the delivery of thoroughly reliable apparatus, first-class in workmanship and in material.

They further consider from time to time improvements in methods and in apparatus suggested by officers or men of the Signal Corps, and supplement these recommendations by careful and comparative studies of similar apparatus in commercial or foreign military use.

Much has been accomplished toward the standardization of articles and the formulation of efficient methods and apparatus for field work.

#### SIGNAL CORPS MANUALS.

During the year the Chief Signal Officer of the Army, recognizing the necessity for keeping the technical publications of the office in line with rapidly advancing improvements, has had Signal Corps Manuals Nos. 1, 3, and 4 thoroughly revised and enlarged in scope.

Manual No. 1 (Telephones) has been combined with Manual No. 3 (Electrical Instruments and Equipments) in one enlarged publication, now designated as Manual No. 3. The various advances in telegraphy,

line construction, telephony, subterranean and aerial cable work have been brought up to date.

Manual No. 4 (Submarine Cables) has been much enlarged and improved. It includes a description of the method of operation of the long submarine cables of the Alaskan system, and, in addition, contains an extension of the chapters on testing and location of faults.

In order to keep up with the rapid changes and advances in the equipment, especially of fire-control apparatus, the electrical division issued two publications for limited distribution to those immediately interested—Memorandum No. 4 treating of the new fire-control apparatus installed at Fort Monroe, Va., and Memorandum No. 5, which describes in a complete way the use of the electrical engineers' testing sets.

#### ELECTRICAL FIRE-CONTROL STAFF.

This force, composed of electrical engineers and other expert assistants, is assigned to the military departments as the exigencies of the service demand. Electrical Engineer R. A. Klock, stationed in Washington under the direction of Maj. Edgar Russel, officer in charge of the electrical division, has general supervision of the working plans and specifications for the fire-control service and of the testing room of the Signal Corps.

Extensive fire control work in the Department of the East is technically supervised by Electrical Engineer Townsend Wolcott, who with several assistants also make inspections of electrical material and supplies. Electrical engineers are also on duty in the Department of California, Department of the Gulf, Department of the Columbia, on the cable ship *Burnside* in Alaskan waters, and the cable ship *Liscum* in Philippine waters.

Several of these assistants are men of marked professional ability and, with rare exceptions, expert, resourceful, and tactful in their difficult work.

#### ESTIMATES AND EXPENDITURES.

The estimates of the Signal Corps pertain to appropriation bills, that for fire-control installations for coast defense relating to the fortification bill, while the rest of the estimates relate to the army bill.

The estimates for the Army proper, despite increased work, are not increased, while those for Alaskan cable purposes are entirely omitted.

The estimates for fire-control purposes, although confined to emplacements already constructed, are necessarily larger than the appropriations for the present year.

#### MILITARY DEPARTMENTS.

Under paragraph 1594, Army Regulations, department commanders supplement the operations of the Signal Corps by such instruction in visual military signaling as they deem necessary for the public service. The instruction in the line of the Army contemplates that each independent command should have at least two enlisted men able to exchange messages in the army and navy code at short distances by flag. Deficiencies in instructing the line of the Army in military sig-

naling has in part resulted from inability to assign a signal officer to each military department. Of the nine departments in the United States, it has been possible to supply only four throughout the year with a signal officer. At the end of the fiscal year these signal officers were as follows: Department of the East, Lieut. Col. George P. Scriven; Department of the Gulf, First Lieut. William A. Covington; Department of Texas, First Lieut. George V. H. Moseley, First Cavalry; Department of California, Maj. George O. Squier; Department of the Columbia, Maj. William A. Glassford; Department of the Colorado, Second Lieut. John S. McCleery, Twentieth Infantry; Department of the Missouri, Capt. Charles McK. Saltzman; Department of Dakota, First Lieut. Walter S. Grant, Third Cavalry; Department of the Lakes, Maj. Hunter Liggett, Military Secretary.

Several other officers of the line have also served as department signal officers for brief periods, performing these duties in addition to others having a prior claim.

Under these conditions the Signal Corps has been fortunate in obtaining in all cases good, and in some cases very efficient, service from detailed officers.

The Department of the Columbia appears to lead as regards efficiency in visual signaling.

Military telegraph lines, treated elsewhere, have been operated in the departments of the Colorado, Texas, the Missouri, and Dakota.

Special attention has been given to fire-control work, as stated elsewhere, in the departments of the East, the Gulf, the Columbia, and California.

Posts garrisoned entirely by the Signal Corps are: Fort Wood, Department of the East; Fort Omaha, Department of the Missouri, and Benicia Barracks, Department of California, these being spoken of under the head of "Signal corps posts."

#### SIGNAL CORPS POSTS.

The Chief of Staff recommended, and the Secretary of War approved, the plan of stationing signal corps companies in the United States at selected posts with a view to their more economical utilization in case of emergency and their suitable training for special work.

The plan looked to the stationing of a separate signal corps command, so that it might cover the general needs of the service in each of the four military divisions. This has been accomplished by the garrisoning entirely of Fort Wood, New York Harbor, for the Atlantic Division; Omaha Barracks for the Northern Division, and of Benicia Barracks for the Pacific Division. There being no convenient post in the Southwestern Division these interests are to be cared for by the signal corps company stationed at Fort Leavenworth, Kans., where it is also utilized in connection with the Signal School lately opened at that post. In this connection the signal corps post, Fort Myer, Va., is abandoned, its stores and garrison being transferred to Omaha Barracks, which has been officially designated as the central signal corps post of the United States with a garrison of four companies.

This rearrangement promises to largely increase the professional efficiency of the men and officers of the Signal Corps, and likewise establishes harmonious relations with the line of the Army, as the troops of the Signal Corps are now serving under identically the same conditions as the artillery, cavalry, and infantry.

Special classes of duties are cared for by the different posts in addition to ordinary signal-corps work. At Fort Wood, which has been most efficiently commanded by Capt. George C. Burnell, Signal Corps, a special school of instruction in fire-control work, submarine cables, etc., has been established, this post being a depot for all fire-control material east of the Rocky Mountains. At this post is stationed Company G, Signal Corps, and in its infrequent periods of inaction the cable boat *Cyrus W. Field* will be there located.

At Omaha Barracks, which is now garrisoned by two companies, B and D, under command of Maj. Eugene O. Fechet, Signal Corps, who also serves as chief signal officer Department of the Missouri, will be ultimately concentrated the principal methods of instruction for enlisted men of the Signal Corps. Pending this concentration steps have been taken to coordinate the instruction of the men at different posts so that those transferred may not lose the advantage of instruction already given.

At Fort Leavenworth, signal corps Company A has been assigned as part of the garrison. This experimental step has been most fruitful in its results, the company, under the command of Capt. William Mitchell, Signal Corps, having won the commendations of the various post commanders for its soldierly and efficient condition. In addition to garrison work, it is also utilized for the purpose of instructing students of the Staff College, Cavalry, Infantry, and Signal schools at Fort Leavenworth. This company has been brought to a very high degree of efficiency and can be put into the field at an hour's notice equipped for signal-corps work of any kind or character, excepting only submarine cables and ballooning, its specialty being field telegraphy, telephony, and visual communications between separate and rapidly moving bodies of troops.

#### SIGNAL CORPS OF THE NATIONAL GUARD.

The importance of military lines of information has been generally recognized by the organized militia of the United States, and the harmonious relations of the Signal Corps of the Army with the signal organizations of the National Guard have been unceasingly fostered.

There exists, as shown by the last militia report of the War Department, signal corps organizations with commissioned officers and enlisted men in the States of California, Colorado, Connecticut, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maryland, Massachusetts, Michigan, Nebraska, New Hampshire, New Jersey, New York, Ohio, Rhode Island, Texas, Utah, Washington, West Virginia, the Territory of Oklahoma, and the District of Columbia. A detachment under a noncommissioned officer has also been organized in the Territory of Arizona.

Frequent applications have been made, which unfortunately could not be granted, for signal corps detachments of the regular establishment to serve in encampments of the National Guard. The official visit of Capt. Geo. C. Burnell to the encampment of the National Guard of the State of New York, and that of Capt. Geo. S. Gibbs to the encampment of the National Guard of Massachusetts, and the presentation of a professional paper by Capt. Charles McK. Saltzman at the annual meeting of the Interstate Convention of the National Guard, St. Paul,

proved most acceptable to the guard. In both instances great interest was shown by officers of the National Guard in the instruments and methods of the Signal Corps of the Army, which were exhibited with practical illustrations.

Numerous applications have been received from officers of the guard by the Chief Signal Officer of the Army, who has had pleasure in giving definite information not only regarding the character of duties imposed at various times upon the Signal Corps, but also as to the extent and kind of equipment necessary for efficient work in any particular direction, such as visual signaling by day, visual signaling by night, telephone exchange service, telegraphic work, etc.

#### MILITARY MANEUVERS.

In the autumn of 1904 the signal-corps work connected with military maneuvers in the Department of the Columbia was in charge of Lieut. Col. R. E. Thompson, Signal Corps, that in the Department of California by Maj. George O. Squier, Signal Corps, and in the Atlantic Division by Capt. D. J. Carr, Signal Corps. These maneuvers were of great benefit to the Signal Corps, as in connection therewith there were important problems of communication which were solved with advantage to the Corps.

Camp communication was satisfactory, but it is doubtful whether the field electrical communications rise to the standard which the Chief Signal Officer of the Army has set for the Corps. As the maneuvers offered opportunities for experimental work, there were tested several varieties of outpost wire and also experimental methods.

The signal force was in each case insufficient, as experience has demonstrated the impossibility of providing entirely satisfactory field communications for an army corps with less than 2 per cent of the entire strength. In none of the above maneuvers did the Signal Corps have a force of 1 per cent to install and maintain its telegraph and telephone offices. Any defects that have been noted are largely remediable by the employment of an adequate force.

These maneuvers developed the fact that special training, which it is hoped the new Signal School at Fort Leavenworth will give, is necessary before many line officers are fully competent to handle extended lines of information.

On this subject the chief umpire, Maj. William P. Duvall, Artillery Corps, comments upon the performance of the Signal Corps during the military maneuvers at Camp Atascadero, California, in his official report, as follows:

Throughout the maneuvers the operations of the Signal Corps were characterized by painstaking preparation, including carefully drawn orders for each day's work, and by much energy and efficiency during the execution of the exercises. In the main said operations were distinctly successful, much more so than at any of the three other maneuver camps in which this Corps has come under my personal observation.

I can clearly confirm the recurring complaint of the signal officers that commanding officers of the forces often ignore the presence of the instruments, even when at their elbow and in complete readiness for use. Indeed in two cases which I witnessed this neglect was flagrant.

It may be added, that photographs taken in connection with these maneuvers strongly illustrate the value of photography in the study of terrain as well as in the locating of troops.



## MILITARY TELEGRAPH LINES.

The following military lines were in operation at the end of the fiscal year:

From—	To—	Length.	Messages handled.
		<i>Miles.</i>	
Price, Utah .....	Fort Duchesne .....	87.0	7,602
Huachuca, Ariz .....	Lewis Springs .....	19.0	4,157
Willcox, Ariz .....	Fort Grant .....	28.0	2,202
Fort Bayard, N. Mex .....	Bayard .....	3.0	1,581
Holbrook, Ariz .....	Fort Apache .....	92.0	8,528
Fort Assiniboine, Mont .....	Assiniboine .....	1.25	2,543
Fort Myer, Va .....	Fort Washington, Md .....	21.5	3,468
Fort Bliss, Tex .....	El Paso .....	6.0	958
Fort Clark, Tex .....	Spofford Junction .....	9.5	3,287
Fort Brown, Tex .....	Fort McIntosh .....	237.0	22,318
Fort Niobrara, Nebr .....	Valentine .....	4.5	1,575
Total .....	.....	508.75	58,219

Short lines in the departments of the East, California, and Dakota, over which no charge is made, are omitted as comparatively unimportant.

There have been collected for the transmission of commercial telegrams over the military lines in the United States tariffs amounting to \$2,111.06. This amount has been deposited in the Treasury of the United States, as required by law. In addition there has been collected and transferred to connecting commercial companies the sum of \$6,954.41, covering tariffs for messages transmitted by such companies over their lines; 100,932 messages were handled.

The abandonment of a portion of the line from Fort Brown to Fordyce, Tex. (88 miles), and from Fort Ringgold to Fort McIntosh (121 miles) has been decided upon, and sale at public auction is now being negotiated. The section from Fordyce to Fort Ringgold will be maintained as at present.

The Price-Fort Duchesne line will shortly be condemned, and sold upon the completion of the Uintah Railway, now building from Dragon to Duchesne.

The Willcox-Fort Grant line has been submitted for the action of an inspector, with a view to its sale after the abandonment of Fort Grant.

The Bisbee-San Bernardino line, although built by the Government, has since July, 1903, been operated as a telephone line by the Bisbee Improvement Company, under an agreement with the Chief Signal Officer. Efforts were made to transfer this line to the customs service, but without success, and an agreement has been made for its condemnation and sale.

## POST TELEPHONE EXCHANGES.

Appreciating the advisability of providing military posts with suitable telephonic exchanges for the prompt and efficient transaction of public business, the Chief Signal Officer presented the matter to the Chief of Staff, recommending liberal facilities. The necessity of economy made it impracticable, however, to equip posts on a generous scale, so their number and location as fixed by the Chief of Staff was promulgated in War Department General Orders, No. 59, later amended by General Orders, No. 110, current series. As some posts have phones in large excess and others are unprovided action has been taken to reorganize all post systems in accordance with the latest order. It is

hoped that more liberal allotments for this purpose may be practicable in future years.

Complications have resulted from the unauthorized action of some post commanders in admitting private corporations not only to the use of Government lines for private exchange service but for the establishment of pay stations in public buildings. It is recommended that a well-defined policy be formulated for the guidance of the Army. Such policy should in no way discriminate in favor of any officer, should afford equal rights to competing commercial systems, and above all should conform to standard methods of line construction in the way of aerial or submarine cables.

#### TARGET RANGES.

The installation of the standard equipment for target ranges, in conformity with Special Orders, No. 8, April 16, 1904, which was inaugurated during the latter part of the last fiscal year, has been satisfactorily continued along the lines indicated in the last annual report. The installations in general have given satisfaction, and have proven to be a very valuable and almost indispensable adjunct to small-arms firing practice.

Provision was made and supplies were shipped for the equipment of 33 ranges, 24 of which have been installed.

#### COAST SIGNAL STATIONS.

The necessity of installing visual signaling apparatus at the important artillery coast defenses, so as to insure intercommunication between the Army and Navy, is recognized as a matter of importance. Whenever the National Board of Defense, now considering the question of armament and other means, shall have reported action will be taken to install such stations in their order of importance.

#### THE LEWIS AND CLARK EXPOSITION.

The exhibit at this exposition, installed under the general supervision of Major Glassford, has been in charge of a noncommissioned officer of the Signal Corps. Though limited in space it covered all phases of the work except ballooning and fire control. The visual signaling exhibit has been supplemented by heliograph practice between Mount Hood and Portland, under Lieut. John B. De Lancey, through the cooperation of Brigadier-General Williams, commander of the Department of the Columbia.

The exhibit included instruments for all kinds of visual and electrical signaling and telegraphic and telephonic work, to which were added maps, reliefs, etc., connected with military work in Alaska, Cuba, the Philippines, and Porto Rico.

#### INTERNATIONAL WIRELESS CONFERENCE.

The proposed conference for 1905 has been postponed. The Chief Signal Officer of the Army was named as the head of the delegation on the part of the United States thereto, and has collated data for use in connection therewith.

#### AUTOMOBILES.

Although automobilism is as yet unsuitable for general transportation in the field, yet its utility and advisability for self-propelled vehicles for military purposes has been amply demonstrated. Auto-propelled vehicles have been purchased for experimental uses as parts of telegraphic trains.

## BALLOONING.

While the contemplated abandonment of signal corps post, Fort Myer, Va., has prevented ballooning work during the past year, yet much preliminary work has been done with a view to effective service when the location for ballooning and its plants for making and compressing gas are permanently settled. Investigations looking to important advances in the inflation of balloons in the field are now in progress.

## WAR DEPARTMENT TELEGRAPHIC CODE.

This code is in the process of revision and will appear at a very early date. It is believed that as regards the character of its code words, the scope of its phrases, its compactness and practicability, there will be very marked improvements upon the present code.

## SIGNAL SCHOOL, FORT LEAVENWORTH.

In coordinating the military instruction of the Army, the General Staff recommended, as promulgated in General Orders, No. 115, War Department, June 27, 1904, certain special service schools, among which is the Signal School, Fort Leavenworth, Kans.

The purpose of the school is to prepare the junior officers of the Signal Corps for the active duties of their profession, to provide theoretical and practical signal instruction for detailed line officers, and to improve the service of the Corps by practical tests and experiments with a view of the application of current industrial inventions to military purposes. The year's course covers visual signaling, electrical and mechanical engineering, aeronautics, photography, topography, and Spanish.

Particular importance is attached to field and practical operations, with directions and suggestions as to the higher theoretical courses. Fortunately the presence of a highly trained signal company affords unusual facilities for practical operation and management of lines of military information, whether visual, telegraphic, buzzer, telephone, or wireless, and in both temporary and permanent form.

The Signal School is under Gen. J. Franklin Bell, who coordinates its workings with other service schools at Fort Leavenworth. Maj. George O. Squier, Signal Corps, is assistant commandant and in direct charge. The school opened September 1, 1905, with 9 student officers, of whom only 3 were from the Signal Corps, owing to lack of officers and to pressure of duties elsewhere.

It is hoped that the seeming discrimination against the graduates of the Signal School through their nondesignation as qualified to enter the Staff College may be removed. Graduates from the other service schools and officers of engineers are qualified for entrance.

## WIRELESS TELEGRAPHY.

The Signal Corps interests itself in wireless telegraphy in the United States only as far as relates to equipping its field trains with portable outfits and to establishing such short routes as will insure prompt and reliable intercommunication between coast defenses and cooperating military forces.

As regards artillery stations there has been maintained the system connecting Fort H. G. Wright and Fort Schuyler, while that from Fort Hancock to Fort Wadsworth has been restored. An installation is in progress at Fort Wood, which will complete an intercommunicating

system between the principal posts of the three artillery districts which defend the approaches to New York City, thus affording alternate routes in war or other emergency.

Pending the perfection of signal corps portable sets, commercial types are now in use for intercommunication during artillery target practice.

The devising of suitable field sets is intrusted to Maj. George O. Squier and to Capt. Leonard D. Wildman. The former officer has demonstrated his unusual ability and resourcefulness in wireless telegraphy by his extraordinary success in the Nome-St. Michael installation. Major Squier's theoretical knowledge of the subject is widely recognized.

The devices when perfected will be given thorough field tests before adoption, and it is expected that a wireless set, capable of working 15 or 20 miles, can be transported on a single pack mule and be installed in a few minutes.

A most interesting result of Major Squier's wireless experiments was the discovery that vegetable antennæ are most efficient, and that growing trees are available for communication at distances of 30 or 40 miles. With the view of determining the conditions under which trees would be available for military systems, the Chief Signal Officer of the Army has directed that experiments be made to ascertain the degree of utility of trees when in full sap, under drought, or frozen, and also the relative value of different species of vegetation.

#### FIRE-CONTROL CABLE BOAT.

The absolute impossibility of repairing fire-control cables by commercial boats was demonstrated by the unrepaired condition of the cables in the artillery district of New London for a period of seven months, leaving the Sound approaches of New York City defenseless. As a result the cable boat *Cyrus W. Field* was purchased and equipped, with the realization that she is unsuited for ocean work. It has been impossible for the *Field* to keep in repair the cables now laid, and another year will show the necessity of either obtaining another boat, or the disagreeable alternative of interrupted cables and disabled coast defenses. It will be absolutely necessary to build one seagoing and two harbor cable boats. Assuming that the *Field* can properly care for the Boston and Portland artillery districts, there is needed a seagoing boat for the districts of eastern New York, southern New York, and the Delaware, with harbor boats for San Francisco on the Pacific, and for the districts of the Potomac, the Chesapeake, and Baltimore on the Atlantic coast. The *Burnside* can care for Puget Sound in addition to her Alaskan work.

On this subject Lieutenant-Colonel Scriven, chief signal officer Department of the East, says:

The experience of the past year has clearly shown the importance and value of the signal corps cable boat *Cyrus W. Field* now in commission. It has further demonstrated that this boat alone, especially in the stormy months of winter, is entirely incapable of maintaining the expensive cable systems already laid in harbors throughout the department from Portland, Me., to the capes of Virginia; the necessity for an additional cable boat for harbor work, and also for a larger seagoing ship, has become manifest.

Capt. Basil O. Lenoir, Signal Corps, who has most efficiently commanded the *Field* in its operations, reports that the condition of recovered cables emphasizes the futility of attempting to handle submarine cables with improvised boats and a force whose whole time is not

devoted to the laying of cables, and the great danger of doing more harm than good. He adds:

A list of cables recovered, found to be unserviceable and in need of much repair due to improper handling and laying, accentuate the uselessness of attempting to handle cables unless provided with the best of appliances and with a well-trained personnel. These can not be hired from civil life for coast cables; there being no demand in civil life, they do not exist. Therefore they must be trained especially for this business.

He further reports that the *Field* answers exceedingly well for a coast cable boat, but is hardly strong enough for outside trips in rough weather, as she is flat-bottomed, not being built to withstand the heavy buffeting of the rough seas. In one voyage between New York and Fort Monroe she was in danger of foundering in a moderate gale.

#### FIRE-CONTROL SYSTEM FOR FIELD ARTILLERY.

Among developments in late years one of the most important as regards field artillery is the proper and judicious direction of its fire from under cover. The operations of the South African, and especially of the Russo-Japanese war, indicate the indispensability of a fire-control and fire-direction system which, if properly devised and operated, must greatly increase the efficiency of field artillery. Impressed with the importance of the subject, the Chief Signal Officer of the Army, in line with his action in 1898 as regards coast defenses, recommended that a similar system of fire control and fire direction be devised for the benefit of and operated by the field artillery of our Army.

This recommendation, viewed favorably by the General Staff and approved by the Chief of Staff, resulted in the reference of the question to the Light Artillery Board, to which were added as members Maj. Edgar Russel, Signal Corps, and an officer of the Ordnance Department.

In compliance with the request of Maj. E. D. Hoyle, Corps of Artillery, president of the Board, there was assembled at Fort Riley during the past summer a complete assortment of signal corps appliances for field communication.

While no definite action has been taken regarding the formal adoption of a fire-control equipment for field artillery, yet it is understood that among the material furnished were found methods and apparatus, which, on preliminary trial, proved entirely suitable for this important work.

The ability of the Signal Corps to thus quickly submit apparatus and supplies, thoroughly suited to this most modern development of artillery communications, accords with the policy of the Chief Signal Officer of the Army, which looks to his Corps keeping pace with modern progress, so that the most important discoveries may be utilized to the advantage of the Army.

#### FIRE-CONTROL SYSTEM FOR COAST ARTILLERY.

With a view of cooperating with the artillery, officers of the Signal Corps took under consideration in 1897 the question of electric communications as an adjunct to the system of fire direction then under experiment. Acting on the recommendation of one of these officers, Col. James Allen, the Chief Signal Officer of the Army took steps in 1898 to extend the scope of the artillery work and by suitable electrical means to add a system of fire control.

The time was ripe for such development inasmuch as a disappear-

ing type of gun was under installation at the most important coast defenses, while the enormously increased range of heavy guns had materially reduced the value of artillery fire by direct pointing.

Under these conditions indirect fire, that is firing without seeing the target, became the rule; and its suitable direction and control were matters of the utmost importance. The system evolved and now in operation consists: First, of the proper location of the hostile ship; second, of the prompt and continuous plotting of its movements, which enables its future location at a definite time to be accurately predicted; and third, the delivery of the fire of either one, or all, of the guns and mortars under the direction of the fire commander.

It has been the duty of the Signal Corps to devise and install methods of accurate, reliable, and practically instantaneous transmission, without which such data would be in many cases practically worthless. By a suitable combination of bells, telephones, telautographs, and electric signals, a most efficient and reliable system has been evolved, its only defect, if any, being complexity. During the past summer, however, the systems installed in the artillery districts of Baltimore, the Chesapeake and the Potomac were operated by the Corps of Artillery with great, and it is thought almost constant, success. The position of the hostile ships were usually determined at intervals of fifteen or twenty seconds, and the methods of communication were such that every gun in extensive districts could be simultaneously fired in accordance with the information thus concentrated.

This has not been an easy task owing to the rapid advance in improvements and modifications of seacoast artillery. The question of fire-control communications, its methods and devices, has been thoroughly studied by Maj. Edgar Russel, acting under Col. James Allen's supervision, and it is believed that the Signal Corps has been entirely successful in dealing with these very important, complicated, and difficult interests.

In the early part of the fiscal year the Signal Corps had in process of manufacture quite large amounts of apparatus for installation in the important districts of the Chesapeake, the Potomac, and Baltimore, where the joint exercises of the Army and Navy were to take place during the summer of 1905.

Before adopting many of the important standard instruments, such as telephones, telautographs, and aeroscopes, the Chief Signal Officer of the Army had manufactured a complete system of improvised type apparatus for installation at Fort Monroe, Va. The Chief of Artillery approved of this installation, as it enabled the Board on Artillery Drill Regulations to determine its fitness, by actual practice, for acceptance or modifications, as the Board deemed best.

Necessarily the installation of a very complicated system at Fort Monroe was slow and difficult, as nearly all of the apparatus was tentative in form, thus necessitating much experimenting before its final adoption. It was not until April 19, 1905, that the report of the Board at Fort Monroe was officially received and approved by the Secretary of War.

Meanwhile the Chief Signal Officer of the Army was forced to earlier action, recognizing that otherwise the joint exercises which were to take place in the middle of June, 1905, would find the artillery entirely without apparatus or supplies for this purpose. Upon purely informal information he proceeded to give large orders for material and supplies for the installation of suitable necessary fire-control communica-

tions in these three large districts. If he had waited for the formal report of the Artillery Board, it would have been impossible to have completed the systems, as it requires from three to six months to secure the necessary apparatus.

Fortunately the type of apparatus finally approved was so nearly identical with that already installed that most of it is available for the permanent installations in these districts. In fact, although the installations are nominally temporary in character, it will be found that the substitution of permanent subterranean cables for the temporary aerial cables will in most cases convert them into a permanent system wherever the stations themselves are permanent structures.

Lines of improvements along which the most marked developments in fire-control apparatus have proceeded during the past year are as follows:

*Telephones.*—In telephones, the final adoption of an exceedingly efficient central energy system in place of the old local battery system. The advantages of such a system are apparent and need not be dwelt upon.

A large number of special types of telephones, all involving the same character of circuits, are necessary for the many special classes of service required. At emplacements the telephones are in water-tight iron boxes, which can be installed at any place desired, however exposed. At other stations there are plotters' sets, wall sets, hand sets, and head sets, while for searchlight and similar uses a portable telephone set has been devised. Several special forms of telephone switch boards have also been found necessary. It would be difficult to here give an adequate idea of the elaboration required.

*The telautograph.*—The telautograph, especially for emplacement use, has been so strengthened and improved that it is almost a new apparatus. The emplacement instrument is secured in a massive cast-brass case, practically air-tight, which can be hung anywhere in the emplacement, even on the gun carriage. The transmitter has been redesigned and now is supplied with a thin brass case instead of the wooden one formerly used, thus facilitating the radiation of heat evolved in the operation of this instrument.

The telautograph is necessarily troublesome to keep in order, but it remains the best of the visual communicating instruments which have as yet been brought to the notice of the artillery. Experimental apparatus now under test will, it is hoped, replace this expensive and complicated instrument.

*Time-interval clock and bell systems.*—The time-interval clock and bell systems have been evolved during the past year.

The clock is an accurate and beautiful piece of mechanism and has given excellent satisfaction.

The bells of the long-stroke variety seem to be very satisfactory. In order that the primary station may give the general alarm to various emplacements and secondary stations, in this circuit a strong pattern of vibrating interrupter is employed which operates the bells as if they were vibrating bells. Although apparently a trifling matter, this becomes important because of the liability of the ordinary vibrating bell, even when well made, to get out of order when exposed to water. In this case the vibrators are all condensed into one, which is installed in the primary station, thus retaining the simplicity of the single-stroke bells at outside points.

*The distributing switch board.*—This may be described as the nerve

center of the entire system, as to it is brought each of the wires of the fire command for the purpose of transposition of circuits in case of damage or for other reasons. This board was designed to meet the conditions imposed by the system devised by Lieutenant-Colonel Whistler at Pensacola, and, while providing for the transposition of power circuits, also secures the easy switching of telephonic and similar apparatus on the same board.

*Storage batteries, power boards, motor generators, and boosters.*—These instruments follow as nearly as possible the most approved patterns in commercial practice, with special reference to their durability and ease of repair. Very large quantities of supplies of this character are required in the operation of the electrical plants installed by the Signal Corps at artillery posts.

The *aeroscopes* are dial telegraphs operated on the step-by-step principle and are manufactured under patents of the Gray National Telautograph Company. These instruments are used at primary stations for giving visually data regarding atmospheric conditions and tide.

*Meteorological apparatus.*—This has remained the same in form as in previous years, the standard Weather Bureau thermometers, barometers, anemometers, and psychrometers being utilized. In addition the Signal Corps is having manufactured for the artillery an atmosphere board which gives graphic means of readily computing the data obtained from meteorological instruments.

*Cables for fire-control installations.*—The Signal Corps has labored earnestly to obtain the best types of cables which can be furnished by manufacturers. An important advance has been the substitution in many instances of paper lead-covered cables for rubber cables. This is a very great gain in compactness and is in line with the best commercial practice. Without this the enormous multiplication of conductors called for by the approved artillery schemes would speedily make many of the larger installations almost prohibitive in cost and weight of cables required.

*Miscellaneous.*—A large number of special forms of junction boxes, outlet boxes, cut-out cabinets, and similar accessories for taking care of cable terminals and other circuits have been worked out by the engineering department of the Office. When it is considered that the apparatus will be subjected to the rough conditions of military service, frequently operated by men of little or no experience in electrical matters, and in places inaccessible for repairs, it will be understood that the engineers of the Signal Corps have dealt with many difficult and unique problems.

#### CIVILIAN ENGINEERS AND ELECTRICAL ASSISTANTS.

At the beginning of the fiscal year there were 2 electrical engineers, 5 assistant electrical engineers, and 5 electrical assistants employed. Due to the magnitude of the fire-control work initiated, it was found necessary to employ additionally 3 assistant electrical engineers and 9 electrical assistants.

Under the apportionment of funds recommended by the Chief of Artillery, extensive operations began in March, 1905, looking to the installation of permanent systems in the artillery districts of southern New York, eastern New York, Portland, Me., Boston, the Chesapeake, and Baltimore. As the work was initiated in the largest districts, the most active employment of engineers and assistants have been around New York.



On the whole, the work of these engineers and assistants during the year has been exceedingly satisfactory. A very careful method of selection has prevailed, and those appointed have, in general, been men of excellent technical attainments.

In New York, Mr. Townsend Wolcott, the senior electrical engineer, has had general charge of the work there centering, especially supervising the inspection of large quantities of supplies there purchased. Mr. Wolcott's attainments as an engineer, added to his long experience in the Signal Corps, have made his services most valuable.

Mr. R. A. Klock, electrical engineer, especially charged with fire-control matters at the Office of the Chief Signal Officer of the Army, has done a very large amount of important technical work, and has discharged his duties with the highest intelligence and zeal. His experience in fire-control matters has made his technical advice of the greatest value to the Office.

The engineers in charge of fire-control work in the artillery districts of the Chesapeake, Potomac, and Baltimore—Messrs. W. M. Chubb, J. R. Whitehead, and L. R. Krumm—during the joint exercises of the Army and Navy acquitted themselves with the greatest credit. There were few interruptions in the complicated systems at each place, and these were in almost all cases due to inexperience in the use of the apparatus rather than to any innate fault in the electrical installation itself.

#### PROGRESS OF FIRE-CONTROL INSTALLATIONS.

The battle-exercise installations in the artillery districts of Baltimore, the Chesapeake, and the Potomac were in a considerable measure temporary, owing to the fact that very few of the approved stations existed. In the Potomac they can, however, be considered as practically complete. In the two other districts the permanency of installation depends largely on the replacement of the temporary aerial cables by subterranean cables.

Permanent fire-control installations are in progress in the artillery districts of eastern New York, southern New York, Portland, and Boston. They will be pushed to completion as rapidly as the work of other bureaus will permit.

Reconstruction or extension of existing temporary installation has been undertaken in the artillery districts of Narragansett, New London, and Pensacola.

In order to afford every artillery command opportunities for target practice a system of temporary fire control, largely telephonic, was devised which, meeting the approval of the Chief of Artillery, is now in course of installation in the artillery districts of Delaware, Charleston, Savannah, Key West, Pensacola, Puget Sound, San Francisco, and Columbia. The installation of three very important and expensive cables in the artillery district of Puget Sound connects Forts Casey, Flagler, and Worden, and thus renders the completion of the permanent installation a comparatively easy matter whenever the Signal Corps is advised that the approved stations are ready for fire-control installations.

A. W. GREELY,

*Brigadier-General, Chief Signal Officer of the Army.*

Hon. W. H. TAFT,  
*Secretary of War.*

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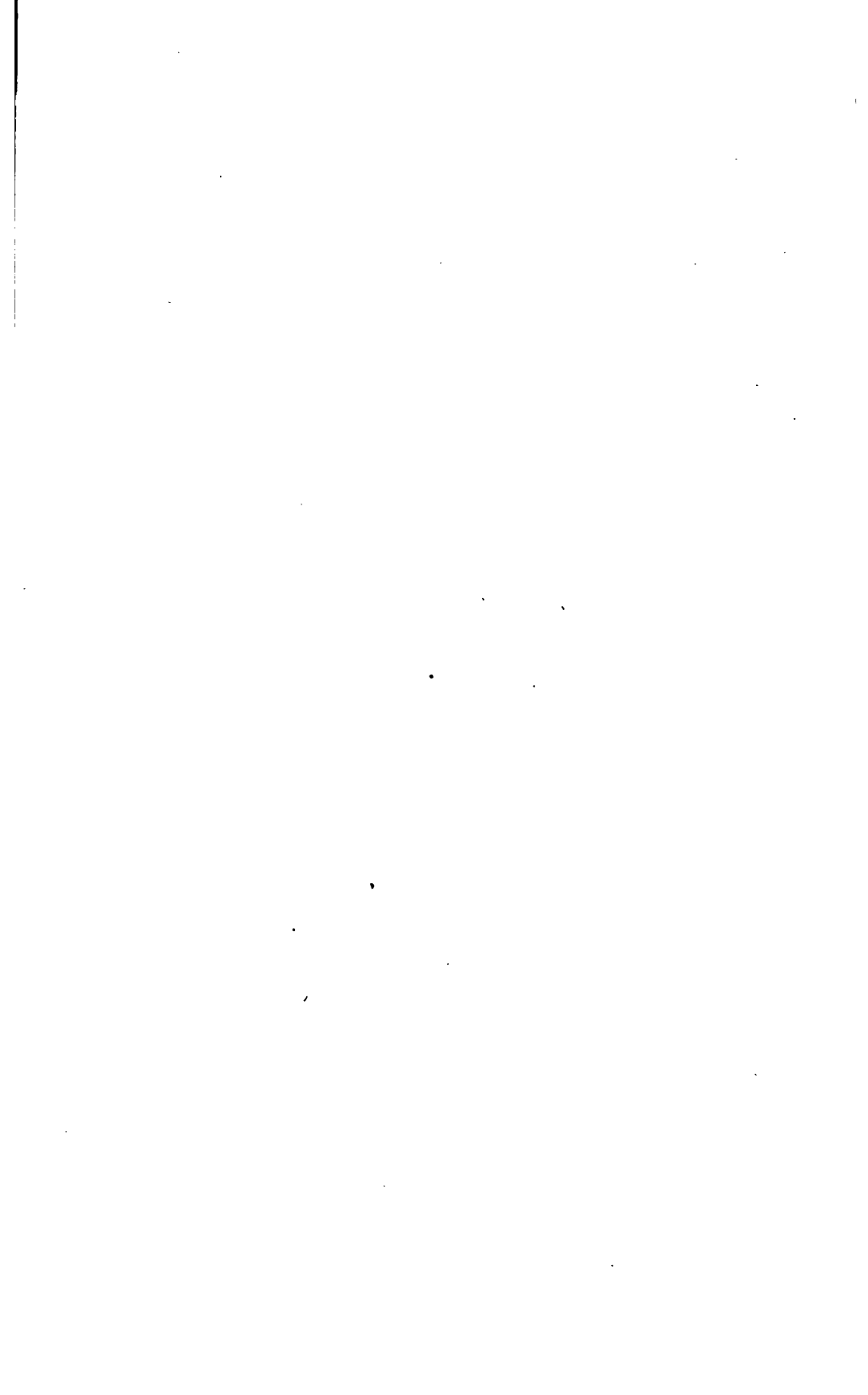
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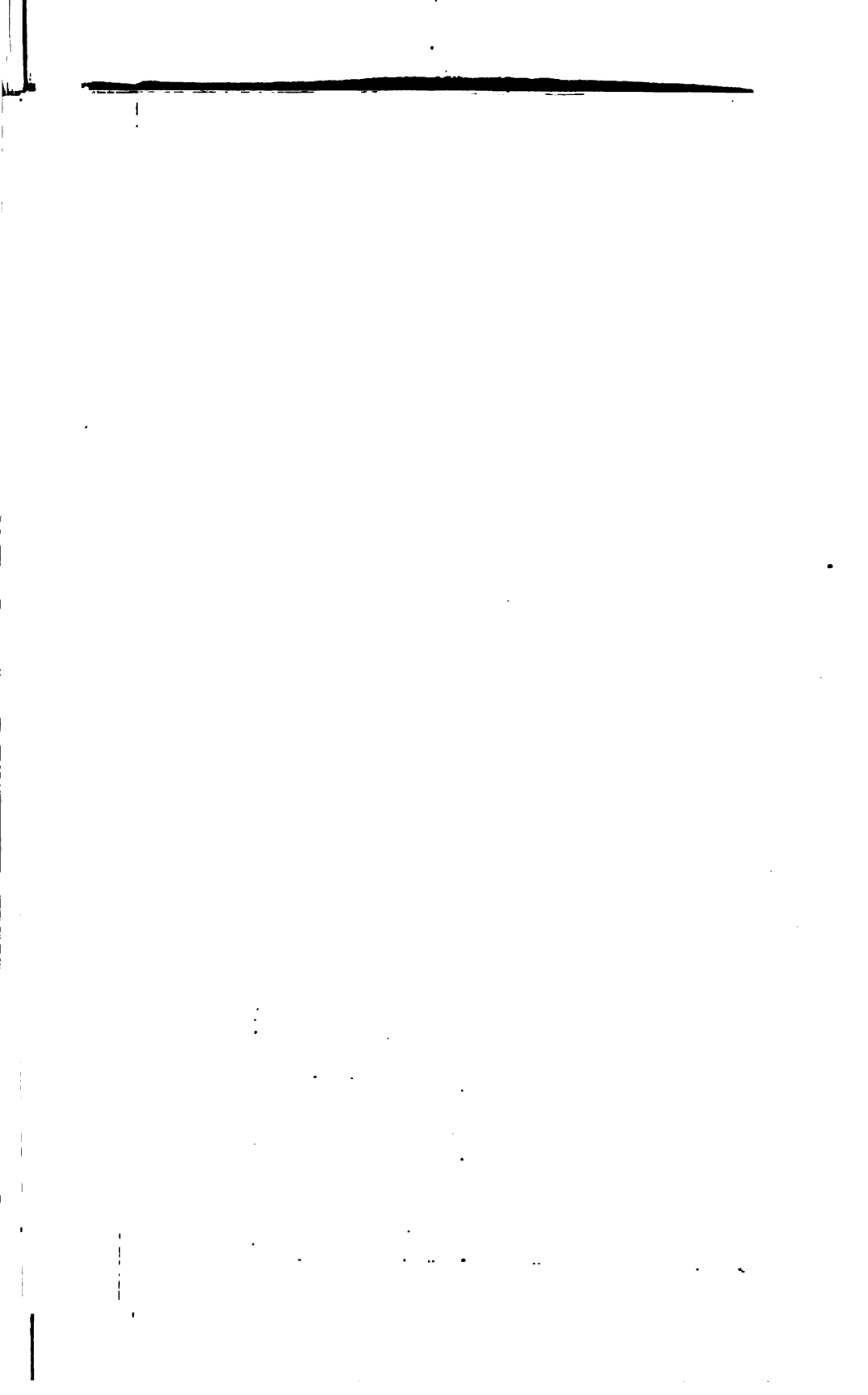
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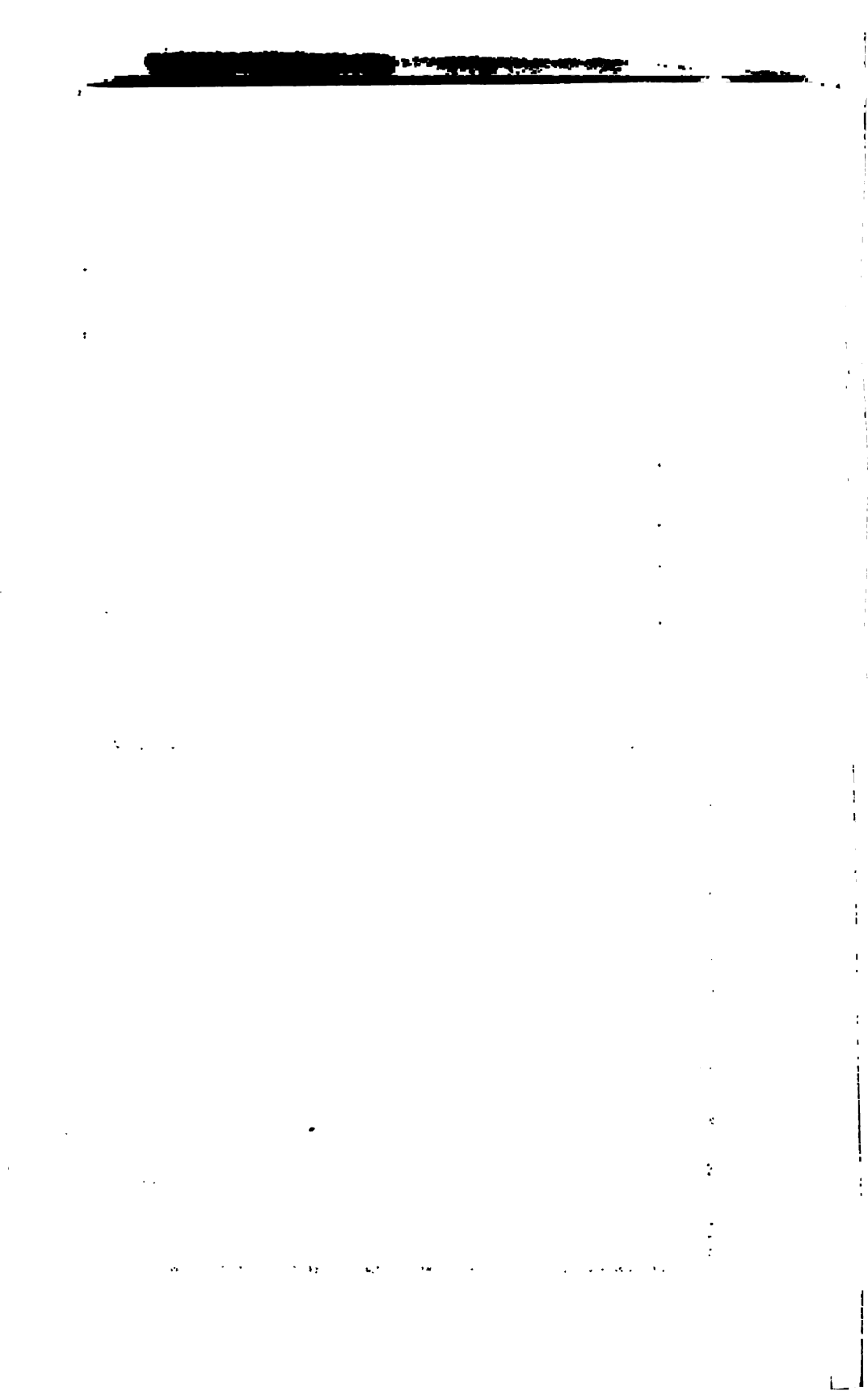






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